

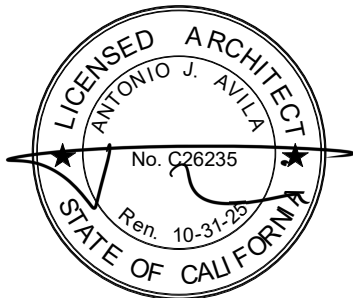
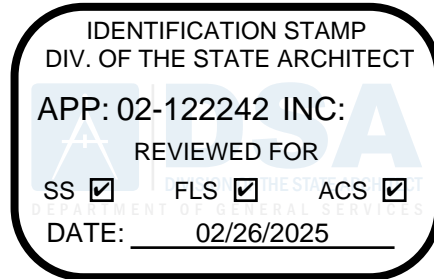
PROJECT MANUAL FOR

**CCC - SPORTS COMPLEX**

**STATE CENTER COMMUNITY  
COLLEGE DISTRICT  
1171 FULTON STREET  
FRESNO, CA 93721**

PREPARED BY:

**DARDEN ARCHITECTS, INC.**  
ARCHITECTURE•PLANNING•INTERIORS  
6790 N. WEST AVENUE  
FRESNO, CALIFORNIA 93711



ARCHITECT



STRUCTURAL ENGINEER



MECHANICAL ENGINEER



ELECTRICAL ENGINEER



CIVIL ENGINEER



LANDSCAPE ENGINEER

END OF SECTION

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*Provided by Owner*

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*Provided by Owner*

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**SECTION 00 22 13.03 – SUPPLEMENTARY INSTRUCTIONS TO BIDDERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Supplementary Instructions to Bidders consisting of procedures and conditions for the use of documents of various types and formats for bidding of this project.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.2 DEFINITIONS**

- A. Hard Copy Format: Documents printed on paper medium.
- B. Electronic Image Format: Electronic Files consisting of Bid Documents in an image format such as PDF's, TIFF's and etc. These files are to be READ ONLY.

**1.3 SUBMITTALS**

- A. Submit in accordance with the following:
  - 1. Bidder's Usage Agreement for Bid Documents:
    - a. Hard Copy and Electronic Image Format Form.

**PART 2 - PRODUCTS  
(NOT APPLICABLE)**

**PART 3 - EXECUTION**

**3.1 SCHEDULES:**

- A. BIDDER'S USAGE AGREEMENT FOR BID DOCUMENTS:
  - 1. HARD COPY AND ELECTRONIC IMAGE FORMAT: When the Bid Documents are being issued electronically, the HARD COPY AND ELECTRONIC IMAGE FORMAT FORM shall be used.
    - a. This form shall be submitted and signed as a condition of receiving Bid Documents.

**SUPPLEMENTARY  
INSTRUCTIONS TO BIDDERS**

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3.2 BIDDER'S USAGE AGREEMENT FOR BID DOCUMENTS HARD COPY AND ELECTRONIC IMAGE FORMAT

Project Name: \_\_\_\_\_

DA Project No.: \_\_\_\_\_

I, \_\_\_\_\_, as duly authorized agent of \_\_\_\_\_  
("Bidder") as prospective bidder on the above named project ("Project") is requesting a copy of the project BID DOCUMENTS (bidding requirements, contract requirements, specifications, contract drawings, resource drawings if any, and addenda to date).

- A. Bidder is being provided copies of Bid Documents for the Project, which consists of two parts. One part of the Bid Documents is in the Hard Copy Format ("HCF") and the other part is in the Electronic Image Format ("EIF") on CD-ROM. Bidder acknowledges that HCF Documents and the EIF Documents are being provided as the official record set of documents issued for bidding. It is the Bidder's responsibility to review and obtain all information from both the HCF and the EIF documents necessary for a complete and accurate bid. This request is subject to the following conditions, which the Bidder hereby agrees to abide by:
- B. Bidder shall pay a non-refundable deposit for the Bid Documents in the amount of (See Instructions to Bidders) per set. In the event the Bidder is not the successful bidder, the bidder agrees to permanently dispose of the HCF and EIF on the Project CD-ROM.
- C. Bidder acknowledges that neither the EIF documents nor the CD-ROM will be updated by the Design Team. The CD-ROM contains the original documents and will not be updated regardless of when Bidder obtains the CD-ROM. Any changes to the contract documents will be issued as a separate document.
- D. Bidder is further warned that while the EIF information appears to be extremely accurate, this apparent accuracy is an artifact of the techniques used to generate it and is no way intended to imply actual accuracy. The Bidder acknowledges and takes full responsibility for the accuracy, correctness of measurements, areas, inventories derived, conclusions drawn, and information extracted from the EIF documents.
- E. Bidder understands and agrees the HCF and EIF documents are instruments of Architect's and Architect's Consultants' ("Design Team") professional service and are intended for one-time use by Bidder in the bidding of the Project. All HCF and EIF documents are and shall remain the property of the Design Team, who is deemed to be the author of the drawings and data, and the Design Team shall retain all common law, statutory law, and all other rights, including copyrights, with respect to Bidder.
- F. The Bidder shall indemnify and hold harmless, the Design Team, its officers, directors, employees or subcontractors, to the fullest extent permitted by law, against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees and defense costs arising out of or resulting from Bidder or any other person or entity that gains information from the Bid Documents or copies any part of the Bid Documents, or uses the Bid Documents or copies any part of the Bid Documents, for purposes other than the bidding of this project, and will be liable to the Design Team for fees equal to the fees paid by the client pursuant to developing the documents for this project.

DARDEN ARCHITECTS, INC.

Description of the HCF Documents and the EIF Documents on CD-ROM, provided:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Print Name (Bidder)

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date:

END OF SECTION

## SECTION 01 11 13 - SUMMARY OF WORK

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work included: Construction of the work for **CCC SPORTS COMPLEX, FRESNO**, California. The work is defined as all material, labor, equipment and services necessary to do all work shown on the drawings and called for in the Specifications. The Work shall be as indicated on the Contract Documents.
- B. This Section includes the following:
  - 1. Summarizes the Work of the Contract.
  - 2. Establishes requirements governing the Work.
  - 3. Identifies the Work that will be performed under separate contracts and the coordination.
  - 4. Project Site access.
  - 5. Restrictions under which the project will be constructed.
- C. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
- D. List below only sections for this Project that the reader might expect to find related work but are specified elsewhere. Verify that the Section titles listed below for this Project's Specifications are correct.
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- A. The words "OWNER" and "DISTRICT" are synonymous and interchangeable, when used throughout this Project Manual.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
  - 1. Quality Assurance/Control Submittals:
    - a. Certificates:
      - 1) Submit three (3) copies of certificates indicating compliance with the Asbestos Hazard Emergency Regulations Act.

## 1.4 QUALITY ASSURANCE

- A. Qualifications:

1. Contractor's Qualifications:

- a. Contractor shall have experience and have successfully completed three (3) projects of similar scope and size to that indicated for this project.
- b. Contractor shall have demonstrated that they have the resources to perform all of the requirements of this project.

B. Regulatory Requirements:

1. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of Work, and in accordance with Specification Section - REGULATORY REQUIREMENTS:
  - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the Project is located.

C. Certifications:

1. The Contractor shall certify in writing that no materials containing Asbestos are incorporated in the work, in accordance with the Asbestos Hazard Emergency Regulations Act.

D. Contractor's Duties:

1. Except as specifically noted, provide and pay for:
  - a. Labor, material and equipment.
  - b. Tools, construction equipment and machinery.
  - c. Heat and utilities required for construction. See Specification Section - TEMPORARY FACILITIES AND CONTROLS.
  - d. Other facilities and services necessary for proper execution and completion of Work.
2. Pay legally required sales, consumer and use taxes.
3. Secure and pay for all site specific as necessary for proper execution and completion of Work.
  - a. Licenses.
  - b. Permits and Fees.
  - c. Government Fees.
  - d. Royalties.
4. Give required notices.
5. Promptly submit written notice to Architect of observed variance.
6. Enforce strict discipline and good order among employees. Do not employ on Work:
  - a. Unfit persons.
  - b. Persons not skilled in assigned task.

1.5 WORK UNDER OTHER CONTRACTS

A. General Requirements:

1. Work under separate contracts will occur throughout the duration of the project. The work being installed under separate contracts will occur around adjacent to the Contract project site.
2. Contractor shall coordinate its work with the work under separate Contracts and shall cooperate with the Contractors of these separate Contracts as they occur.
3. Should the Contractor damage and/or otherwise alter work installed under separate contracts, the Contractor is responsible for the repair and/or correction of installed work.
4. Prior to the installation of the Work, coordinate the work installed or to be installed by separate contracts relative to this project scope of work.

B. Work by Owner:

1. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this contract or work by Owner. Coordinate the work of this Contract with work performed by Owner.
2. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be constructed simultaneously with work under this Contract.
  - a. Items that are Owner Furnished Contractor Installed and Owner Furnished Owner Installed as indicated on the Contract Drawings and as defined in Specification Section - OWNER FURNISHED ITEMS.
3. Security and Intrusion Alarm System: Owner's Vendor will design the Intrusion Alarm System and identify pathways that need to be provided under the Contractor's Construction Contract.

C. Work Under Separate Contracts by Others:

1. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the work of this Contract with work performed under separate contracts.
2. Concurrent Work: Owner will award a separate contract(s) for the following construction operations at the Project Site. Those operations will be conducted simultaneously with work under this Contract.

1.6 PROJECT CONDITIONS OR SITE CONDITIONS

A. Access to Site:

1. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of the Project.
2. Contractor shall be responsible for coordinating access to and from the site throughout the duration of the project. Access to and from the site may vary, based upon timing and duration of separate contracts.
3. The Contractor shall not use the Off-Site areas, with the exception of the Site Access per Specification Section - TEMPORARY FACILITIES AND CONTROLS, and shall not interfere with the work in these areas.

B. Contractor Use of Premises:

1. Confine operations at sites to areas permitted by:
  - a. Laws.



- b. Ordinances.
  - c. Permits.
  - d. Contract Documents.
- 2. Do not unreasonably encumber site with materials or equipment.
  - 3. Assume full responsibility for protection and safekeeping of Contractor's and Owner's material stored on premises, and keep the site and building secure at all times.
  - 4. Obtain and pay for use of additional storage Work areas needed for operations.
  - 5. Limit use of Site Work and storage.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

## SECTION 01 23 00 – ALTERNATES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install or remove all materials, accessories and other related items necessary to add or delete from the Project as indicated by the alternates in the Contract Documents.
    - a. Any services such as utilities that are meant to pass thru the Alternate areas that serve other areas not involved shall be maintained as part of the Base Bid whether indicated or not.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the BID FORM for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the work. No other adjustments are made to the Contract Sum.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Quality Assurance/Control Submittals:
    - a. Notification Letter:
      - 1) Submit three (3) copies of Notification Letter to all concerned on the status of all ALTERNATES.

## 1.4 QUALITY ASSURANCE

- A. Procedures:
  - 1. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into the Project.
    - a. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
    - b. Provide Lump Sum Price (and all itemized prices) for construction of the Base Bid and each Alternate Bid on the BID FORM.

2. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
3. Execute accepted alternate under the same conditions as other work of the Contract.

## PART 2 - PRODUCTS

NOT APPLICABLE

## PART 3 - EXECUTION

### 3.1 SCHEDULE OF ALTERNATES

- A. General: All Alternate descriptions are general in nature. Refer to the contract drawings for specific scope of work.
- B. **[ADDITIVE]** ALTERNATE BID NO. 1: Sod Turf
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Replace hydroseed outside of playfield with turf.
- C. **[ADDITIVE]** ALTERNATE BID NO.2: Horizontal Jumps
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Include (1) horizontal jumps runway and (1) jump pit
- D. **[ADDITIVE]** ALTERNATE BID NO.3: Pole Vault
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Include (1) pole vault runway and (1) pole vault box
- E. **[ADDITIVE]** ALTERNATE BID NO.4: All Jumps
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Include (2) pole vault runways, (4) pole vault boxes, (2) horizontal jumps runways, (4) jump pits
- F. **[ADDITIVE]** ALTERNATE BID NO.5: Concrete work and planters
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Entrance concrete, planters, and benches. Additional concrete along east side of track.
- G. **[ADDITIVE]** ALTERNATE BID NO.6:
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Additional colors for track with retention coat
- H. **[ADDITIVE]** ALTERNATE BID NO.7:
  1. Base Bid: See Specification Section SUMMARY OF WORK.
  2. Alternate: Track and field equipment

END OF SECTION

## SECTION 01 25 00 – SUBSTITUTION PROCEDURES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
1. Work that is substituted for Work specified in DIVISIONS 02 through 49 shall meet the requirements of this Section.
  2. Provide all material, labor, equipment and services necessary to completely install all approved substituted materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
  3. See the INSTRUCTIONS TO BIDDERS or the GENERAL CONDITIONS for any time limits set for the submittal of substitutions.
  4. Substitutions can be requested in two ways: a. "Prior to Bid Opening", and b. "After Award of the Contract":
    - a. "Prior to Bid Opening": The Contractor or Bidder must insure that proposed substitutions of materials by the Contractor or Bidder are submitted to the Architect's office no later than fourteen (14) calendar days prior to the Bid Opening for review and possible approval of any equipment or materials thought to be equal to or better than those specified in the drawings or specifications. An Addendum will be issued no later than three (3) calendar days prior to Bid Opening including all equipment and materials deemed equivalent to those specified and approved by the Architect.
    - b. "After Award of the Contract": In accordance with the provisions of Section 3400 of the California Public Contract Code, the Contractor awarded the Contract will be provided a period of thirty-five (35) calendar days after the award of the Contract for submission of data substantiating a request for a substitution of "an equal" item or items.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
1. DIVISION 00 SPECIFICATION SECTIONS.
  2. DIVISION 01 SPECIFICATION SECTIONS.
  3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- A. Claimant: Bidder, Sub-Contractor, Contractor, Distributor, Supplier, Manufacturer or other entity that is submitting a claim for a substitution.
- B. Substitutions: Substitutions are not a part of the Submittal Process described in Specification Section – SUBMITTAL PROCEDURES. Substitution Requests by a claimant must be reviewed and approved by the Architect before any submittal will be accepted. It is the claimant's responsibility to provide clear and concise documentation to expedite the Architect's review. If the Substitution Request requires re-submission(s) due to the Claimant's inadequate documentation, no time extension will be allowed.

1. Changes to the structural, accessibility, or life-safety portions of the DSA-approved Contract Documents shall be submitted to and approved by DSA as a Construction Change Document, prior to the fabrication and installation as required by California Administrative Code, Title 24, Part 1, Section 4-338, and DSA IR A-6.
  
- C. "Or Equal" / "Or Approved Equivalent": Claimant shall request a substitution in accordance with this Specification Section – SUBSTITUTION PROCEDURES.
  
- D. The Project Manual employs the following methods of specifying products. Claimant shall conform to the directives below for this Project:
  1. Product, system or design specified only by reference standards:
    - a. Select any product, system or design meeting reference standards.
  2. Product, system or design specified by naming several products, systems, designs and/or manufacturers:
    - a. Select any product, system, design and/or manufacturer named.
  3. Product, system or design specified by naming several products, systems and/or manufacturers and reference standards:
    - a. Products, systems, designs and/or manufacturer names indicate products, systems, designs and/or manufacturers that (in the Architect's opinion) meets the reference standards.
    - b. Select any of the named manufacturer's products, systems or designs meeting the reference standards.
  4. Product, system or design specified by naming one or more products, systems, designs and stating "or equal to," "or approved equivalent," with the specified products, systems or designs:
    - a. Select product, system or design specified, "or approved equivalent."
  5. Product, system or design specified by naming only one product, system or design:
    - a. Select product, system or design specified, "or approved equivalent."
  6. Product, system or design specified by naming only one product, system or design and followed by the statement "DISTRICT STANDARD – NO SUBSTITUTIONS":
    - a. Provide product, system or design specified. No substitutions allowed.
  
- E. Cost to Claimant for review of Substitution Request:
  1. Each review of a Substitution Request by the Architect and/or it's Consultant(s) will be billed to the Claimant at an hourly rate of **\$212.00** an hour, two hour minimum for each review, whether approved or rejected.
    - a. Waiver of review fees:
      - 1) When the product has been discontinued or is unavailable.
        - a) EXCEPTION: Where the claimant has failed to order in a timely manner and waits until the last minute, no consideration of the waiver of fees will be allowed; no time extensions will be allowed.
      - 2) When the Owner has requested a substitution.

### 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - INSTRUCTIONS TO BIDDERS:
  
- B. Content of Request:
  1. Check made payable to DARDEN ARCHITECTS, INC. for the minimum two hour review period for **\$424.00**, non-refundable.
    - a. When additional time is required to review a substitution request beyond the first two hours, the Architect or its consultants will bill the claimant for the time expended in the review process.

2. Complete the attached **SUBSTITUTION REQUEST FORM** substantiating compliance of proposed substitution with Contract Documents. **NO OTHER FORMS WILL BE ACCEPTED.**
  3. Attach to the SUBSTITUTION REQUEST FORM an itemized comparison of proposed substitution with product, system or design specified.
  4. For products or systems, attach to the SUBSTITUTION REQUEST FORM:
    - a. Product, system or design identification, including manufacturer's name and address.
  5. Manufacturer's product information: **MUST BE HIGHLIGHTED AND PROJECT SPECIFIC. SUBMITTALS NOT ADEQUATELY MARKED-UP ACCORDING TO PROJECT SPECIFICS WILL BE REJECTED:**
    - a. Literature including product, system or design description, performance and test data and reference standards.
    - b. Samples.
    - c. Warranties.
  6. For construction methods, attach to the SUBSTITUTION REQUEST FORM:
    - a. Detailed description of proposed methods.
    - b. Drawings illustrating methods.
- C. Submit three (3) copies of Substitution Request including all attached data.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
1. Product, system or design qualifications:
    - a. In making a request for substitution, Claimant certifies that:
      - 1) Claimant has personally investigated proposed product, system or design, and determined that it is equal or superior in all respects to that specified.
      - 2) Claimant shall provide the same guarantee or warranty for substitution as for product, system or design specified.
      - 3) Claimant shall coordinate installation of accepted substitution into the Project, making such changes as may be required for the Project to be complete in all respects.
      - 4) Claimant waives all claims for additional costs related to substitution which subsequently become apparent for integrating the substituted product, system or design into the Project.
      - 5) Claimant waives all claims for time extension(s) due to improper documentation requiring re-submission(s) of a Substitution Request Review.
- B. Regulatory Requirements:
1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. Products (and installation standards), systems or methods used for this Project shall comply with CARB standards in effect at the Project Site, and at the time of installation.
- C. Acceptance of Substitutions:
1. Procedures:
    - a. The Contract is based on products, systems or designs described in the Contract Documents.

- b. Architect will consider proposals submitted in accordance with time limits set within the Specification Section - INSTRUCTIONS TO BIDDERS.
  - c. Architect is solely responsible for judging the acceptance of substitutions.
    - 1) Acceptance of a substitution does not waive the product manufacturer's responsibility for product liability. The Architect will judge (based on the substitution submission data) for function and use – product liability shall remain the responsibility of the product manufacturer.
  - d. Substitute products, systems or designs shall not be used unless the substitutions have been specifically approved for this Project by the Architect.
    - 1) Substitute products, systems or designs that are related to structural, fire and life safety or access compliance shall not be used unless such substitution have been specifically approved for this Project by the Architect and the appropriate authority having jurisdiction.
2. Substitutions will not be considered if:
- a. They are indicated or implied on product submittals in accordance with Specification Section - SUBMITTAL PROCEDURES. Substitutions are not Submittals, and must be reviewed and approved prior to being submitted as a Submittal.
  - b. Acceptance will require substantial revision of Contract Documents.
  - c. They are submitted after the date set for substitutions within this Contract, unless:
    - 1) The specified or drawing item that has been verified to be discontinued or is otherwise unavailable.
    - 2) The Owner proposes a cost savings for the product, system or method.
    - 3) The Owner proposes early occupancy, and the proposed substitution allows for that convenience.
3. Substitutions affecting DSA-regulated items shall be considered as construction documents (CCD's) and shall be approved prior to fabrication and installation per DSA IR A-6 and Section 338(c) Part 1, Title 24 CCR.

PART 2 - PRODUCTS  
NOT APPLICABLE

PART 3 - EXECUTION

3.1 SCHEDULES

- A. Substitution Request Form:
  - 1. See the form attached to the end of this section.
  - 2. The attached form will be reproduced (and sequentially numbered by the Contractor after the award of the Contract) by the Claimant for any and all proposed substitutions.
  - 3. **NO OTHER FORMS WILL BE ACCEPTED.**

*(Attachment)*

**SUBSTITUTION PROCEDURES**  
**SUBSTITUTION REQUEST FORM**

2175

TO: DARDEN ARCHITECTS, INC. \_\_\_\_\_ Check attached for minimum review \$424.00.  
6790 N. West Avenue  
Fresno, CA 93711

CHECK APPROPRIATE LINE:

\_\_\_\_\_ Substitution Request Prior to Bid (During Bid Period)  
\_\_\_\_\_ Product or System Substitution  
\_\_\_\_\_ Design Change Substitution  
  
\_\_\_\_\_ Substitution Request After Award of the Contract  
\_\_\_\_\_ Product or System Substitution  
\_\_\_\_\_ Design Change Substitution

The Contractor Awarded the Contract for this Project shall assign sequential Substitution Request # below.  
Leave blank if submitted during the Bid Period.

SUBSTITUTION REQUEST # \_\_\_\_\_  
WE HEREBY SUBMIT FOR YOUR CONSIDERATION THE FOLLOWING PRODUCT OR  
METHOD AS SUBSTITUTION FOR THE SPECIFIED OR DRAWING ITEM FOR THIS PROJECT:  
PROJECT: \_\_\_\_\_  
SPECIFIED ITEM: \_\_\_\_\_

Specification Section #	Page #	Paragraph #	Description
OR DRAWING ITEM: _____			

Drawing #	Detail Cut #	Description

PROPOSED CREDIT IF ANY: \_\_\_\_\_  
PROPOSED SUBSTITUTION: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.  
Attached data also includes a description of changes to the Contract Documents to which the proposed substitution will require for its proper installation.



**SUBSTITUTION PROCEDURES**

**2175**

The undersigned claimant certifies: (Modifications by the claimant to the following list is cause for automatic rejection without further review)

1. The proposed substitution does not affect dimensions shown on drawings or code requirements indicated.
2. The undersigned claimant shall compensate the Architect at a rate of **\$212.00** an hour, two hour minimum for each review (check for **\$424.00** must be attached to this form), for investigation and comments whether or not the request is approved for changes required to the building design, including engineering design, detailing, and construction costs caused by the requested substitution. The Architect is herein defined as any of those firms or individuals listed by reference on the Drawings, including all Consultants identified herein.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed substitution.
5. Attach information for a minimum of three projects where the substitution has been used locally within a 200 mile distance of this project, including names, addresses and telephone numbers of Owners who have accepted this product into their projects.
6. Attach all cost data with explanations if different from Specified or Drawing item. Include in that explanation a discussion on quality of proposed substitution and cost differential.
7. The undersigned claimant shall pay for any subsequent changes in incorporating the proposed substitution that were not apparent at the time of approval into the Work, including compensation to the Architect as described in item 2 above.

The undersigned Claimant(s) declares under penalty of perjury per the California Government Code Section 12650, et seq., that the claim of function, appearance and quality are equivalent or superior to the specified or drawing item, and further know and understand that submission for certification of a false claim may lead to fines, imprisonment and/or other severe legal consequences.

**SUBMITTED BY CLAIMANT:**

Signature \_\_\_\_\_  
Firm \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

Telephone \_\_\_\_\_

**ADDITIONAL CLAIMANT SIGNATURE REQUIRED:**

**The Contractor or Construction Manager  
if submitted after the Award:**

Signature \_\_\_\_\_

Firm \_\_\_\_\_

**DESIGN CONSULTANT USE ONLY:**

- ☐ Check Not Attached - Not Accepted  
☐ Accepted  
☐ Accepted as Noted  
☐ Not Accepted  
☐ Received Past Time Period Allowed by Public Contract Code #3400.

By \_\_\_\_\_ Date \_\_\_\_\_

Remarks \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

END OF SECTION

## SECTION 01 29 73 – SCHEDULE OF VALUES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This section includes the administrative and procedural requirements necessary to prepare and process the following:
  - 1. Schedule of Values
    - a. Schedule of Bid Values.
    - b. Complete Schedule of Values.
  - 2. Unit Price Schedules.
  - 3. Application for Payment with Certification.
- B. Related Requirements: The following Project Manual Sections contain requirements that relate to this section:
  - 1. 01 11 13 SUMMARY OF WORK.
  - 2. 01 21 13 ALLOWANCES.
  - 3. 01 23 00 ALTERNATES.
  - 4. 01 32 16 CONSTRUCTION SCHEDULE.
  - 5. 01 32 26 FORMS AND REPORTS.
  - 6. 01 33 00 SUBMITTAL PROCEDURES.
  - 7. 01 41 00 REGULATORY REQUIREMENTS.

## 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring and controlling the construction project. Activities included in a Schedule of Values and Payment Request consume cost for time and resources.
- B. Activity Code: Identifies each activity so as to be organized, group and sorted into Sub-Schedules, Areas of Work, and Reports.
- C. Allowances: Contract amounts allocated for specific activities of the project as identified in the contract documents.
- D. Application for Payments: A statement furnished by the Contractor allocating portions of the Contract Sum to various portions of the Work stipulating the amount of work that has been completed to date.
- E. Contingency: Contract amounts allocated for non-specific activities, to cover changes in the contract document work, unforeseen conditions and added scope of work to the project.
- F. Major Scope: Significant portions of work identified as, but not limited to, Base Bid, Alternate Bids, and Construction Phases, and Funding Criteria.
- G. Responsible Party: Entity that is responsible for performing the work of each activity as identified, but not limited to, General Contractor, and Sub-Contractor, second and tertiary tier Sub-Contractors, Manufacturers, Fabricators and Vendors.

- H. Schedule of Values: A statement furnished by the Contractor allocating portions of the Contract Sum to various portions of the Work.
- I. Scope Type: Segments of work identified as, but not limited to, Building ID, On-Site, and Off-Site.
- J. Sub-Schedules: Separated activities identified as part of the same element of work and arranged to show correlation with related elements.
- K. Unit Prices: A price per unit of measurement for materials, equipment, or services, or a portion of the Work that are applicable during the duration of the Work.

#### 1.4 SUBMITTALS

- A. General:
  - 1. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
- B. Format for Submittals: A tabular form type schedules.
  - 1. Provide a working electronic copy of schedule file.
    - a. Provide schedule files on Compact Disc (CD) or Digital Versatile Disc (DVD) (WINDOWS Formatted Disks) in a form that can be reviewed and used by the Owner, and Architect.
  - 2. Provide PDF electronic copy of schedule file.
  - 3. Provide **Two (2)** paper copies of schedules.
    - a. Sheet size shall be of adequate size to clearly show the required information for the entire construction period.
    - b. All required documentation shall have the Submittal number posted in the upper-right hand corner of the page.
- C. Assurance/Control Submittals:
  - 1. Schedule of Values.
    - a. Schedule of Bid Values.
      - 1) Submit within **fourteen (14)** days after the Award of Contract.
    - b. Complete Schedule of Values.
      - 1) Submit at the earliest possible date, but no later than **fifteen (15)** days prior to the date scheduled for submittal of initial Application for Payment.
  - 2. Application for Payment and Certification.
    - a. Application for Payment and Certification Forms.
      - 1) Submit along with the Complete Schedule of Values submittal.
    - b. Initial Application for Payment.
      - 1) Submit [**seven (7)** days prior to due date.
    - c. Application for Payment for Progress of Work.
      - 1) Submit monthly by the date directed by Owner.
    - d. Application for Payment at Substantial Completion.
      - 1) Submit after Architect issues the Certificate of Substantial Completion.
    - e. Final Application for Payment.
      - 1) Submit after competing Project Closeout requirements.
  - 3. Schedule of Unit Price.

#### 1.5 SYSTEM DESCRIPTION

- A. General:

1. The Architect considers the project Schedule of Values requirements to be significant to both the Contractor and the Owner. The development, submittal, and acceptance of the Schedule of Values, (Bid and Complete), and subsequent development and maintenance of the Application for Payments must be given high priority.
    - a. No payment will be made without the Architect's review and acceptance of the Schedule of Values.
    - b. Progress payments may be withheld in whole or part should the Contractor fail to comply with the requirements of this section.
    - c. No separate payment will be made to the Contractor for any of the requirements of this section. All such costs shall be part of the Contractor's planned project overhead costs included in its bid.
  - B. Performance Requirements:
    1. Schedule of Bid Values: The Schedule of Bid Values shall be a breakdown of the Bid(s) submitted in the Bid Proposal and shall include all work that was bid on, regardless the scope of work awarded for construction. The breakdown shall be sufficient for the use by the Owner and Owner's Consultants to evaluate and determine cost of major scopes of work and the value of other owner agreements that are associated with the dollar value of the bid proposal.
      - a. Refer to Specification Section - SUMMARY OF WORK.
    2. Complete Schedule of Values: Breakdown of the Contract Sum by specific line-item values, based on the individual activities in the Baseline Project Construction Schedules and to be the basis for the development of the Application for Payment.
      - a. Refer to Specification Section - CONSTRUCTION SCHEDULES.
    3. Application for Payments: Shall be derived from Baseline Project Construction Schedule utilizing the costs in the Complete Schedule of Values, and from subsequent Project Construction Schedule Updates, reflecting the Work performed as of planned and actual dates.
      - a. Refer to Specification Section - CONSTRUCTION SCHEDULES.
    4. Unit Prices: If the Scope of Work or estimated quantities of Work by the Contract Documents is increased or decreased, Unit Prices are added to or deducted from the Contract Sum by appropriate modification.
- 1.6 QUALITY ASSURANCE
- A. Qualifications:
    1. The Contractor must have the capacity and capability of supporting the project by producing schedule-related data within **two (2)** days of request by the Architect, or Owner.
  - B. Regulatory Requirements:
    1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Coordination:
  1. Coordinate preparation of the Schedule of Bid Values with the submitted Bid Proposal and reflect the major scope of work breakdown described in Specification Section – SUMMARY OF WORK and Specification Section -- ALTERNATES.
  2. Coordinate preparation of the Complete Schedule of Values with the preparation of the Baseline Project Construction Schedule. Refer to Specification Section -- CONSTRUCTION SCHEDULES.

3. Correlate line items in the Complete Schedule of Values with other required administrative forms and schedules, including, but not limited to, the following:
  - a. Application for Payment forms with continuation sheets.
  - b. Submittals Schedule.
  - c. Items required to be indicated as separate activities in the Baseline Project Construction Schedule.

B. Project Information:

1. Identification: Include the following Project Identification on all Schedule of Values and Application for Payment.
  - a. Project Name and Location.
  - b. Name of Owner and Address.
  - c. Name of Architect and Address.
  - d. Architect's Project Number.
  - e. Contractor's Name and Address.
  - f. Submittal Date.

## 2.2 SCHEDULE OF BID VALUES

A. Format:

1. Arrange the Schedule of Bid Values in tabular form.
  - a. Provide and identify separate columns to indicate the following;
    - 1) SPECIFICATION SECTION.
    - 2) DESCRIPTION.
    - 3) RESPONSIBLE PARTY.
    - 4) MAJOR SCOPE.
    - 5) DOLLAR VALUE.
    - 6) PERCENTAGE OF THE CONTRACT SUM.
  - b. Provide and identify separate line-items to indicate the following;
    - 1) Activity.
    - 2) Contract Conditions.
    - 3) Allowance(s).
    - 4) Contingency (ies).
    - 5) Grand Totals.

B. Content:

1. SPECIFICATION SECTION: Use the specification section number in the Project Manual Table of Contents to identify and establish each line-item.
2. DESCRIPTION: Provide a description of the work for each line-item associated with the specification section and responsible party.
3. RESPONSIBLE PARTY: Identify the party responsible for performing the work of each line-item associated with the specification section and description.
4. MAJOR SCOPE: Designate Major scope of work as identified and itemized in BID PROPOSAL.
  - a. Provide separate columns for each Major Scope of Work identified.
5. DOLLAR VALUE: Sub-Total of the cost for each activity line-item, with the amounts rounded to the nearest dollar.
  - a. Assign a dollar value for each line-item to each Major Scope of the project excluding General Conditions, General Requirements and General Contractor's Overhead and Profit.
6. PERCENTAGE OF THE CONTRACT SUM: Dollar Value as a percentage of the Contract Sum to the nearest one-hundredth percent, adjusted to total one hundred percent.

7. Activity: Provide at least one activity item-line for the work in each Specification Section.
  - a. Provide separate activity line items for each Contractor or Subcontractor providing work under the same specification section.
8. Contract Conditions:
  - a. Identify and provide separate activity line-item for cost items that are directly related to Division 01 - GENERAL REQUIREMENTS.
  - b. Identify and provide separate activity line-item for cost items that are directly related to Division 00 - CONDITIONS OF THE CONTRACT.
9. Allowances: Identify and provide separate activity line-item for each Allowance that is assigned for specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit.
10. Contingencies: If required, identify and provide separate activity line-item for each Contingency that is not assigned to specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit.
  - a. If required, provide separate line items for Owner Contingency and Contractor Contingency.
11. Grand Total: Summation of dollar value for each column equal to the Bids received.

## 2.3 COMPLETE SCHEDULE OF VALUES

### A. Format:

1. Provide a comprehensive, fully developed, detailed Complete Schedule of Values in tabular form.
  - a. Provide and identify the following separate columns to indicate the following for each item listed;
    - 1) SPECIFICATION SECTION.
    - 2) ACTIVITY CODE.
    - 3) DESCRIPTION.
    - 4) RESPONSIBLE PARTY.
    - 5) MAJOR SCOPE.
    - 6) SCOPE TYPE.
    - 7) DOLLAR VALUE.
  - b. Provide and identify separate line-items to indicate the following;
    - 1) Activity.
    - 2) Sub-Schedules.
    - 3) Contract Conditions.
    - 4) Allowances.
    - 5) Purchase Contracts.
    - 6) Contingencies.
    - 7) Grand Totals.

### B. Content:

1. SPECIFICATION SECTION: Use the specification section number in the Project Manual Table of Contents to identify and establish each line-item.
2. ACTIVITY CODE: Provide the Activity Identification Code for each line-item indicated as separate activities in the Baseline Project Construction Schedule.
3. DESCRIPTION: Provide a description of the work for each line-item associated with the specification section and responsible party.
4. RESPONSIBLE PARTY: Identify the party responsible for performing the work of each line-item associated with the specification section and description.
5. MAJOR SCOPE: Designate Major scope of work as identified and itemized in BID PROPOSAL

6. SCOPE TYPE: Identify each line-item that is associated with a segment of work.
7. DOLLAR VALUE: Sub-Total of the cost for each activity line-item, with the amounts rounded to the nearest dollar.
  - a. Assign a dollar value for each line-item to each Major Scope of the project excluding General Conditions, General Requirements and General Contractor's Overhead and Profit.
8. Activity: Provide at least one activity item-line for the work in each Specification Section.
  - a. Provide separate activity line items for each Contractor or Subcontractor providing work under the same specification section.
  - b. Include entities responsible for performing the work of each activity, identified as, but not limited to, General Contractor, and Sub-Contractor, second and tertiary tier Sub-Contractors, Manufacturers, Fabricators and Vendors.
  - c. Include separate activity line-items for cost items that are directly related to Division 01 - GENERAL REQUIREMENTS and are direct cost of actual work-in-place. Such items shall be, but not limited to, the following;
    - 1) Submittals,
    - 2) Field Engineering,
    - 3) Operation and Maintenance Manuals.
    - 4) Demonstration and Training.
9. Sub-Schedules:
  - a. Major Scope of Work: Provide Sub-Schedules for line-items that are associated with each designated major scope of work as identified in Bid Proposal, and defined in Specification Section -- SUMMARY OF WORK and Specification Section -- ALTERNATES that requires itemization of each line-item value.
  - b. Scope Type: Provide Sub-Schedules for line-items that are associated with each specific scope type.
    - 1) Building Costs: Detailed cost breakdown of all cost items that are directly related to the Project per Building.
      - a) When the Project Building(s) is of sufficient size to warrant, break the building costs down into areas of work compatible with the Contractor's Means and Methods for construction sequences.
      - b) Building areas may consist of floor and roof levels and partial floor and roof levels.
    - 2) Project Site Costs: Detailed cost breakdown of all cost items that are directly related to the Project Site.
      - a) When the Project Site is of sufficient size to warrant, break the site costs down into areas of work compatible with the Contractor's Means and Methods for construction sequences.
10. Contract Conditions: As defined in the Schedule of Bid Values and the following;
  - a. Expand to include separate activity line-items for cost items that are directly related to Division 01 - GENERAL REQUIREMENTS and are not direct cost of actual work-in-place. Such items shall be, but not limited to, the following;
    - 1) Temporary Facilities.
    - 2) Field Supervision.
    - 3) Project Identification Sign.
    - 4) Project Closeout Requirements.
      - a) Punch List Activities, and Project Record Documents.
  - b. Expand to include separate activity line-item for cost items that are directly related to Division 00 - CONDITIONS OF THE CONTRACT REQUIREMENTS and are not direct cost of actual work-in-place. Such items shall be, but not limited to, the following;
    - 1) On-Site Facilities and Supervision.

- 2) General Contractor's Overhead and Profit.
- 3) Performance and Labor and Material Bonds.
- 11. Allowances: Identify and provide separate activity line-item for each Allowance that is assigned for specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit..
- 12. Purchase Contracts: Provide separate line-item in the Schedule of Values for each Purchase Contract, showing the value of the Purchase Contract.
- 13. Contingencies: If required, identify and provide separate activity line-item for each Contingency that is not assigned to specific work in any specification section. Dollar value to exclude General Contractor's Overhead and Profit.
  - a. If required, provide separate line items for Owner Contingency and Contractor Contingency.
- 14. Grand Total: Summation of dollar value for each column equal to the Bids received.

## 2.4 UNIT PRICES

- A. Unit Prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead and profit.
  - 1. Breakdown prices into:
    - a. Delivered cost of products(s) including tax.
    - b. Total installed cost excluding overhead and profit.
    - c. Add Contractor's and subcontractor's overhead and profit costs after subtotal and provide a final total.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established Unit Prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to the Contractor.

## PART 3 - EXECUTION

### 3.1 APPLICATION AND CERTIFICATION FOR PAYMENT

- A. General Requirements:
  - 1. Coordination: Coordinate the preparation of the Application for Payment with the preparation of the Complete Schedule of Values and Project Construction Schedule.
    - a. Entries shall match data on the Complete Schedule of Values and Project Construction Schedule and Project Schedule Updates, if revisions were made.
  - 2. Application and Certification for Payment Forms: Use forms accepted by the Architect and Owner for Applications for Payment.
    - a. Form shall be based on AIA Document G702 Application and Certification for Payment and AIA Document G703 Continuation Sheets.
    - b. Submit form for acceptance with initial submittal of Complete Schedule of Values.
  - 3. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of the Contractor. Project Inspector or Architect will return incomplete applications without action.
    - a. Use signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include Waivers of Lien and similar attachments if required.



4. Identification: Include the following Project Identification on all Application for Payment:
  - a. Project Name and Location.
  - b. Owner Name.
  - c. Architect's Project Number.
  - d. Contractor Name and Address.
  - e. Application Number.
  - f. Application Date.
  - g. Period To:
- B. Format.
  1. Provide a comprehensive, fully developed, detailed Application for Payment with Continuation Sheets in tabular form.
    - a. Provide and identify the following separate columns to indicate the following for each item listed;
      - 1) ACTIVITY CODE.
      - 2) DESCRIPTION.
      - 3) SCHEDULED DOLLAR VALUE.
      - 4) WORK COMPLETED.
        - a) FROM PREVIOUS APPLICATION.
        - b) THIS PERIOD.
      - 5) TOTAL COMPLETED.
      - 6) PERCENTAGE OF COMPLETION.
      - 7) BALANCE TO FINISH.
      - 8) RETAINAGE.
    - b. Provide and identify separate line-items to indicate the following the following;
      - 1) Activity.
      - 2) Sub-Schedules.
      - 3) Contract Conditions.
      - 4) Allowance(s).
      - 5) Purchase Contracts (if applicable).
      - 6) Contingency (ies).
      - 7) Grand Totals.
      - 8) Change Orders.
- C. Content:
  1. ACTIVITY CODE: Provide the Activity Identification Code for each line-item of Work as indicated as separate activities in the Project Construction Schedule.
  2. DESCRIPTION OF WORK: Provide the same description as indicated in the Schedule of Values for each line item.
  3. SCHEDULED DOLLAR VALUE: Provide the same amount as indicated in the Schedule of Values for each line item.
  4. WORK COMPLETED: with the following sub-columns.
    - a. FROM PREVIOUS APPLICATION, include Dollar Value for work completed in previous Application for Payment, whether or not payment has been received.
    - b. THIS PERIOD, include only the Dollar Value for work completed at the time of Application for Payment.
  5. TOTAL COMPLETED: The sum Dollar Value of Work Completed and Materials Presently Stored.
  6. PERCENTAGE OF COMPLETION: The percentage value of the total Work Completed and the Stored to Date divided by the Scheduled Value.
  7. BALANCE TO FINISH: The dollar value of the Scheduled Value minus the Total Completed.

8. RETAINAGE: The dollar value of the percentage of retention per contract agreement.
  9. Activity:
    - a. Use the Complete Schedule of Values and Baseline Project Schedule as a guide to establish activity line-items for the Application for Payment.
    - b. Include separate activity line-items when a work activity is separated into stages and requires separate payments for each stage.
    - c. Provide separate line-items for each part of the Work where separate payments will be requested including, but not limited to, submittals, materials, equipment, fabrication and installation.
    - d. Provide separate line items for materials stored but not yet installed, where separate payments will be requested.
  10. Sub-Schedules: As described in the Complete Schedule of Values.
  11. Contract Conditions: As described in the Complete Schedule of Values.
  12. Allowances: As described in the Complete Schedule of Values.
  13. Purchase Contracts: As described in the Complete Schedule of Values
    - a. Indicate Owner payments or deposits, if any, and balance to be paid by the Contractor.
  14. Contingencies: As described in the Complete Schedule of Values.
  15. Grand Totals: As described in the Complete Schedule of Values.
  16. Change Orders:
    - a. Include amounts of approved Change Orders or Construction Change Directives issued before the last day of construction period covered by application.
- D. Supplemental Information:
1. Materials Stored: Include in Application for Payment the amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site.
    - b. Provide certificate of insurance or Bonded Warehousing, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
    - c. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
    - d. Provide summary documentation for stored materials indicating the following:
      - 1) Materials previously stored and included in previous Applications for Payment.
      - 2) Work completed for this Application utilizing previously stored materials.
      - 3) Additional materials stored with this Application.
      - 4) Total materials remaining stored, including materials with this Application.
  2. Waivers of Mechanic's Lien: With each Application for Payment, submit Waivers of Mechanic's Liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
    - a. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
    - b. When an Application shows completion of an item, submit conditional final or full waivers.
    - c. Owner reserves the right to designate which entities involved in the Work must submit waivers.
    - d. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
    - e. Waiver Forms: Submit waivers of lien on forms executed in a manner acceptable to Owner.

- E. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for payment include the following:
1. List of Subcontractors.
  2. Schedule of Values.
  3. Contractor's Construction Schedule (preliminary if not final).
  4. Products List (preliminary if not final).
  5. Schedule of Unit Prices.
  6. Submittal Schedule (preliminary if not final).
  7. List of Contractor's Staff Assignments.
  8. List of Contractor's Principal Consultants.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial Progress Report.
  11. Report of Preconstruction Conference.
- F. Application for Payment for Progress of Work:
1. Each Application for Payment shall be consistent with previous applications and payments as certified by the Project Inspector, Architect, and paid for by the Owner.
  2. Payment Applications shall be submitted to the Architect by the date established by the Owner. The maximum period of time covered by each Application for Payment is for one month.
  3. Payments Applications shall be updated to reflect any revised activity in the Project Schedule Updates.
- G. Application for Payment at Substantial Completion: After the issuing of the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portions of the Work claimed as substantially complete.
1. Include documentation supporting the claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- H. Final Application for Payment: Submit Final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement accounting for final changes to the Contract Sum.
  4. "Contractor's Affidavit of Payment of Debts and Claims."
  5. "Contractor's Affidavit of Release of Liens."
  6. "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

### 3.2 SCHEDULE OF UNIT PRICES

- A. Specification Section - CAST-IN-PLACE CONCRETE:
1. Concrete slabs per thickness per square foot.
  2. Concrete foundations per cubic yard.
  3. Concrete walls per cubic yard.

- B. Specification Section - PLUMBING:
  - 1. Utility trenching, pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.
- C. Specification Section - ELECTRICAL:
  - 1. Utility trenching, sleeve pipe or conduit pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.
- D. Specification Section - COMMUNICATIONS:
  - 1. Utility trenching, sleeve pipe or conduit pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.
- E. Specification Section - ELECTRONIC SAFETY AND SECURITY:
  - 1. Utility trenching, sleeve pipe or conduit pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.
- F. Specification Section - EARTHWORK:
  - 1. Scarification and compaction of existing soil per cubic yard.
  - 2. Excavation and compacted placement of existing suitable site soil for non-engineered fill per cubic yard.
  - 3. Delivery and compacted placement of import soil per cubic yard.
  - 4. Delivery and compacted placement of import soil for grading per cubic yard.
  - 5. Rough grading per square foot.
  - 6. Finish grading per square foot.
- G. Specification Section - STORM DRAINAGE:
  - 1. Delivery and installation of catch basins per individual catch basin size.
  - 2. Trenching, pipe placement and backfill per pipe diameter size per linear foot at specific trench depths.
  - 3. Miscellaneous storm drainage items per item.

END OF SECTION

**SECTION 01 31 13 – CONTRACTOR'S PROJECT MANAGEMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This section includes the administrative and procedural provisions for construction operations.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.2 DEFINITIONS**

- A. BIM: Building Information Modeling.
- B. CAD: Computer Aided Design and Drafting.
- C. RFI: Request for Information. Seeking information required by or clarifications of the Contract Documents.
- D. MINUTES: A method of documenting key topics discussed with a focus on decisions made and directions given and by whom during a meeting. A verbatim transcript is not necessary.

**1.3 SUBMITTALS**

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
- B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities, list telephone numbers, and e-mail addresses. Provide names, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Keep list available and current at all times.

**1.4 COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in the Contract Documents to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination of Multiple Contracts: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in the Contract Documents that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.
- D. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- E. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.
- 1.5 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Architect's Data Files Not Available: Architect will not provide Architect's CAD drawing digital data files for Contractor's use during construction.
- B. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect, if available, for Contractor's use during construction, as per written request made by the Contractor.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
  2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  3. Digital Drawing Software Program: Contract Drawings are available in Auto CAD.
  4. Contractor, and other parties granted access by Contractor to Architect's digital data files, shall execute attached data licensing agreement form "USER AGREEMENT FOR ELECTRONIC FILES."
- C. Web-Based Project Management Software Package: Use of Contractor' web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion, is acceptable.
1. Web-based Project management software includes, at a minimum, the following features:
    - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    - g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.
    - l. Mobile device compatibility, including smartphones and tablets.
  2. Provide up to seven (7) Project management software user licenses for use by users as identified by Owner and Architect.
  3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
- D. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with bookmarks enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
  3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.
  4. Do not submit password protected documents or restricted documents.

**1.6 REQUEST FOR INFORMATION (RFI)**

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. RFIs submitted to Architect by other parties controlled by Contractor will be returned without response.
  - 2. Coordinate and submit RFIs in a prompt manner to avoid delays in work.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Owner name.
  - 3. Owner's Project number.
  - 4. Name of Architect.
  - 5. Architect's Project number.
  - 6. Date.
  - 7. Name of Contractor.
  - 8. RFI number, numbered sequentially.
  - 9. RFI subject.
  - 10. Specification Section number and title and related paragraphs, as appropriate.
  - 11. Drawing number and detail references, as appropriate.
  - 12. Field dimensions and conditions, as appropriate.
  - 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 14. Contractor's signature.
  - 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Use forms accepted by the Architect and Owner. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
  - 1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  - 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
  - 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.



- a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within five (5) days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include not less than the following:
  - 1. Project name.
  - 2. Name and address of Contractor.
  - 3. Name and address of Architect.
  - 4. RFI number, including RFIs that were returned without action or withdrawn.
  - 5. RFI description.
  - 6. Date the RFI was submitted.
  - 7. Date Architect's response was received.
  - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three (3) days if Contractor disagrees with response.

#### 1.7 COORDINATION DRAWINGS

- A. Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
  - 2. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Above Ceiling: Indicate subframing for support of ceiling, and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenums to accommodate layout of light fixtures, fire sprinklers, mechanical ducts, support structures, structural elements (beams, joist, trusses) and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  6. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
  7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  8. Fire-Protection System: Show the following: Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  9. Site Utility Coordination: Show the following:
    - a. Existing and proposed underground and surface utility improvements including gas, domestic water, fire water, chilled water, hot water, irrigation, storm sewer, sanitary sewer, electrical power, and communications. No site improvements shall be installed prior to Architect's and Owner's review of coordination drawing. Architect's and Owner's review is only for general conformance with the Contract Documents. Contractor is responsible to obtain their own GPR Services to locate utilities within the construction site area.
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Structural Steel, Wood Framing, Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
  2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
  3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
  4. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.

5. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
6. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

**D. Coordination Digital Data Files:** Prepare coordination digital data files according to the following requirements:

1. File Preparation Format:
  - a. Same digital data software program, version, and operating system as original Drawings, operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using PDF format, or in a format as requested by the Architect.

**1.8 PROJECT MEETINGS**

**A. General:** Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

**B. Preconstruction Conference:** Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conduct matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
  - a. Introductions, responsibilities and personnel assignments.
  - b. Tentative construction schedule.
  - c. Phasing.
  - d. Critical work sequencing and long lead items.
  - e. Designation of key personnel and their duties.
  - f. Lines of communications.
  - g. Use of web-based Project software.
  - h. Review of General Conditions/Requirements.
  - i. Procedures for processing field decisions and Change Orders.
  - j. Procedures for RFIs.
  - k. Procedures for Submittals.
  - l. Procedures for Substitutions.
  - m. Procedures for testing and inspecting.
  - n. Procedures for processing Applications for Payment.
  - o. Distribution of the Contract Documents.
  - p. Submittal procedures.
  - q. Sustainable design requirements.
  - r. Preparation of Record Documents.

- s. Use of the premises.
  - t. Work restrictions.
  - u. Working hours.
  - v. Owner's occupancy requirements.
  - w. Responsibility for temporary facilities and controls.
  - x. Procedures for moisture and mold control.
  - y. Procedures for disruptions and shutdowns.
  - z. Construction waste management and recycling.
  - aa. Parking availability.
  - bb. Office, work, and storage areas.
  - cc. Equipment deliveries and priorities.
  - dd. Project Safety.
  - ee. Security.
  - ff. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner and Architect of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility requirements.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conduct matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for preparing operations and maintenance data.
    - f. Requirements for delivery of material samples, attic stock, and spare parts.
    - g. Requirements for demonstration and training.
    - h. Preparation of Contractor's punch list.
    - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    - j. Submittal procedures.
    - k. Coordination of separate contracts.
    - l. Owner's partial occupancy requirements.
    - m. Installation of Owner's furniture, fixtures, and equipment.
    - n. Responsibility for removing temporary facilities and controls.
  4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conduct matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.

- 2) Sequence of operations.
  - 3) Status of submittals.
  - 4) Status of sustainable design documentation.
  - 5) Deliveries.
  - 6) Off-site fabrication.
  - 7) Access.
  - 8) Site use.
  - 9) Temporary facilities and controls.
  - 10) Progress cleaning.
  - 11) Quality and work standards.
  - 12) Status of correction of deficient items.
  - 13) Field observations.
  - 14) Status of RFIs.
  - 15) Status of Proposal Requests.
  - 16) Pending changes.
  - 17) Status of Change Orders.
  - 18) Pending claims and disputes.
  - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conduct matters relating to the Work. Advise Owner and Architect of scheduled meeting dates.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site use.

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- 8) Temporary facilities and controls.
  - 9) Work hours.
  - 10) Hazards and risks.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of RFIs.
  - 14) Proposal Requests.
  - 15) Change Orders.
  - 16) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

**PART 2 - PRODUCTS**

NOT APPLICABLE

**PART 3 - EXECUTION**

NOT APPLICABLE

**END OF SECTION**

**CONTRACTORS PROJECT  
MANAGEMENT**

**USAGE AGREEMENT FOR ELECTRONIC FILES  
Release of Liability**

**Documents Transmitted By:**     **Darden Architects, Inc.**  
   **6790 N. West Ave.**  
   **Fresno CA 93711**

PROJECT NAME: \_\_\_\_\_

ARCHITECT PROJECT NO.: \_\_\_\_\_

PROJECT ARCHITECT: \_\_\_\_\_

I \_\_\_\_\_, as a duly authorized agent  
of \_\_\_\_\_ - (Contractor) have an agreement for construction  
services on the above named project. The Contractor acknowledges having received at least one (1)  
complete set of Contract Documents for the project and has posted all Addenda and all other contract  
documents issued to date.

The Contractor is requesting the electronic CAD files of work prepared by the Architect and/or  
Architect's Consultants (Design Team) on the subject project, so that the information therein may be  
utilized in the Contractor's work on the same project. The Contractor understands that these files are  
being provided as a courtesy and they are strictly intended for the Contractor's sole convenience and they  
are not recognized Contract Documents. This request is subject to the following conditions, which the  
Contractor hereby agrees to abide by:

1. It is understood and agreed to that any files and/or documents provided are instruments of  
professional service by the Design Team and are intended for one-time use solely in the  
construction of this project. They are and shall remain the property of the Architect or the  
Architect's Consultants, who is deemed to be the author of the drawings and data, and who shall  
retain all common law, statutory law, and all other rights, including copyrights.
2. The Contractor shall indemnify and hold harmless, the Design Team, its officers, directors,  
employees or subcontractors, to the fullest extent permitted by law, against all claims, liabilities,  
losses, damages, and costs, including but not limited to attorney's fees and defense costs arising  
out of or resulting from contractor's use of these electronic files, or in any way connected with the  
modification, misinterpretation, misuse, or reuse by the Contractor or by others.
3. The Contractor agrees that by using these electronic files, the Contractor is in no way relieved of  
the duty to fully comply with the Contract Documents, including and without limitation, the need  
to check, confirm and coordinate all dimensions and other details, take field measurements, verify  
field conditions and coordinate with all other contractors for the project.
4. It is agreed to that these electronic files are not Contract Documents. Differences may exist  
between electronic files and corresponding hard-copy Contract documents. The Design Team  
makes no representation regarding the accuracy or completeness of the electronic files provided  
to the contractor. In the event that a conflict arises, the signed and sealed hard-copy Contract  
Documents shall govern. Contractor is responsible for determining if any conflict exists.
5. The Contractor understands that the Design Team makes no representation as to the compatibility  
of these files with Contractor's computer hardware or software. The Contractor understands that  
the accuracy of the information is an artifact of the techniques used to generate it and is in no way



**CONTRACTORS PROJECT  
MANAGEMENT**

intended to imply actual accuracy. It is also understood that the automated conversion of information and data from the system and format used by the Design Team to an alternate system or format cannot be accomplished without the possibility of introduction of inexactitudes, anomalies and errors.

6. Because information presented on the electronic files can be modified, unintentionally or otherwise, the Design Team reserves the right to edit the drawings to remove information deemed not necessary and/or remove all indications of ownership and/or involvement from each electronic display.
7. The Design Team will only furnish those drawings directly applicable to the shop drawings the contractor wishes to create. The Contractor understands that not all electronic files may be available at the Design Team's discretion.
8. The Contractor understands that the Architect's Consultants may have Additional Conditions for release of their electronic files or documents, and the Contractor hereby agree to abide by the Consultants conditions in addition to the stated conditions in this agreement. Additional Conditions (if any) are attached to this agreement.
9. The Contractor understands that the Architect and the Architect's Consultants will incur certain costs in providing the requested electronic files. The Contractor agrees to pay the Design Team a service fee of \$120.00 per sheet, per delivery, prior to any delivery of the electronic files to compensate the Design Team for the labor to prepare and transmit the files and for the additional risk that this transfer will occasion.
10. Under no circumstances shall delivery of the electronic files for use by the Contractor be deemed a sale by the Owner, the Design Team, or any member of the Design Team. The Design Team makes no warranties, either expressed or implied, of merchantability or fitness for any particular purpose. In no event shall the Design Team be liable for any loss of profit or any consequential damages as a result of Contractor's use or reuse of the electronic files.

**Darden Architects, Inc.**

Description of the requested documents and/or CAD files:

\_\_\_ Civil    \_\_\_ Structural    \_\_\_ Mechanical    \_\_\_ Electrical    \_\_\_ Other(s)

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\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signed

\_\_\_\_\_  
Dated

## SECTION 01 32 16 – CONSTRUCTION SCHEDULES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - a. Project Construction Schedules.
  - b. Coordination Schedules.
  - c. Schedule Modifications.
  - d. Time Extensions.
- B. Related Requirements:
  - 1. 01 11 13 SUMMARY OF WORK.
  - 2. 01 29 73 SCHEDULE OF VALUES.
  - 3. 01 33 00 SUBMITTAL PROCEDURES.
  - 4. 01 41 00 REGULATORY REQUIREMENTS.
  - 5. 01 45 23 TESTING AND INSPECTION SERVICES.

## 1.3 DEFINITIONS

- A. The following definitions or terms apply to this specification section:
  - 1. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
    - a. Critical Activity is an activity on the critical path that must start and finish on the planned early start and finish times.
    - b. Predecessor Activity is an activity that precedes another scheduled activity.
    - c. Successor Activity: An activity that follows another scheduled activity.
  - 2. Activity Code: Identifies each activity organized, grouped and sorted into Sub-Schedules, Areas of Work, and Reports.
  - 3. Construction Schedule: A logical analysis listing the project's milestones, activities, and deliverables with planned dates for performing the scheduled activities and milestones.
  - 4. Critical Path: The longest continuous chain of activities through the schedule that establishes the minimum overall project duration.
  - 5. Event: The starting or ending point of an activity.
  - 6. Float: The measure of leeway in starting and completing an activity.
    - a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is jointly owned, expiring Project resource is available to both parties as needed to meet the schedule milestones and contract completion date.
    - b. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
    - c. Total float is the measure of leeway in starting of or completing an activity without adversely affecting the planned Project completion date.

7. Milestone: A key or critical point in time for reference or measurement.
8. Inclement Weather: Temperature, Precipitation, Fog, and Muddy conditions that may impede the progress of the Project construction on critical activities for more than fifty percent (50%) of the Contractor's scheduled work day.
9. Responsibility Code: Identify entities that are responsible for performing the work of each activity as identified, but not limited to, General Contractor, Sub-Contractor, second and tertiary tier Sub-Contractors, Manufacturers, Fabricators and Vendors.
10. Unusually Severe Weather: The amount of excessive Inclement Weather that is greater than the anticipated number of Inclement Weather days for any given month.
11. Mud Days: The amount of excessive muddy site conditions which prohibit access to and around the Project site, access to buildings and impedes the progress of the Project construction on critical activities as a result of Unusually Severe Weather.
12. NOAA: National Oceanic and Atmospheric Administration.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
- B. Format for Submittals: A time-scaled bar chart and Gantt-chart-type schedules.
  1. Provide a working electronic copy of schedule file.
  2. Provide schedule files on Compact Disc (CD) or Digital Versatile Disc (DVD) (WINDOWS Formatted Disks) in a form that can reviewed and used by the Owner, and Architect.
  3. Provide PDF electronic copy of schedule file.
  4. Provide Two paper copies of schedules.
  5. Sheet size shall of adequate size to clearly show the required information for the entire construction period.
  6. All required documentation shall have the Submittal number posted in the upper-right hand corner of the page.
- C. Assurance/Control Submittals:
  1. Project Construction Schedules:
    - a. Initial Project Schedule (IPS);
      - 1) Submit within fourteen (14) days after the Award of Contract.
    - b. Baseline Project Schedule (BPS);
      - 1) Submit within twenty-one (21) days after the Notice to Proceed date.
      - 2) Sub-Schedules;
      - 3) Submit as requested by Architect or Owner.
  2. Coordination Schedules:
    - a. Short Interval Schedules (SIS);
      - 1) Submit at the regularly scheduled meetings.
    - b. Monthly Schedule Updates (MSU);
      - 1) Submit seven (7) days prior to the designated regularly scheduled monthly Progress Meeting for Schedule Review.
      - 2) Submit the agreed upon MSU one week prior to monthly progress payments.
  3. Schedule Modifications:
    - a. Change in Sequence;
      - 1) Submit as needed at a regularly scheduled Progress Meeting.
    - b. Recovery Schedule;
      - 1) Submit as needed at a regularly scheduled Progress Meeting.
    - c. Alterations to Schedule;
      - 1) Submit as needed at a regularly scheduled Progress Meeting

4. Time Extension Requests:
  - a. Notice of Delay;
    - 1) Submit within seven (7) days after a delay event, and/or with a Change Order Request (COR) that is in response to a CCD, RFP, or other documents issued by the Architect.
  - b. Inclement Weather;
    - 1) Submit within twenty-four (24) hours after an event.

## 1.5 SYSTEM DESCRIPTION

### A. General:

1. The Architect considers the project schedule requirements to be of significant importance to both the Contractor and the Owner. The development, submittal, acceptance and maintenance of the Initial Project Schedule, Baseline Project Schedule and subsequent Monthly Schedule Updates must be given high priority.
  - a. Progress payments may be withheld in whole or part should the Contractor fail to comply with the requirements of this section.
  - b. No separate payment will be made to the Contractor for any of the requirements of this section. All such costs shall be part of the Contractor's planned project overhead costs included in its bid.

### B. Performance Requirements:

1. The Baseline Project Schedule shall be the basis for evaluating the job progress and time extension requests. The responsibility for developing the Baseline Project Schedule, accurately updating the schedule, and monitoring the actual progress of the work compared to the planned schedule rests solely with the Contractor.
  - a. Failure of the Contractor to include any element of the work or any inaccuracy in the Baseline Project Schedule will not relieve Contractor from the responsibility for accomplishing all the work in accordance with the Contract requirements.
2. Inclement Weather: The Contractor shall have included all impacts to weather dependent activities, resulting from the anticipated Inclement Weather in the Baseline Project Schedule.
  - a. Contractor shall be responsible for all associated time delays and costs.
  - b. Contractor shall be responsible to account for associated mitigating measures which includes, but not limited to, dewatering, mucking, temporary weather protection, gravel roadways, equipment downtime, etc.
  - c. Contractor shall be responsible to account for the site's soil conditions, drainage patterns, and other elements that may be affected.
3. Cost Correlation: The Initial Project Schedule and the Baseline Project Schedule shall be the basis for developing the Schedule of Values and the Work performed as of planned and actual dates used for preparation of The Application for Payment Requests.
  - a. Refer to Specification Section - SCHEDULE OF VALUES.
4. Early Completion Schedules: Early completion schedules may be prohibited due to certain physical or monetary constraints imposed upon the Owner.
  - a. If not prohibited, and is contemplated by the Contractor as part of its bidding strategy, it is hereby expressly understood by the Contractor that early completion schedules will only be acceptable under the condition that the schedule be reasonable and realistic.
  - b. The Contractor certifies that it has included general conditions costs in its bid sufficient for the entire contractual time of performance.
  - c. No damages for delay will be recoverable if the project is prolonged beyond the early completion date, but still completed within the entire contract duration.

## 1.6 QUALITY ASSURANCE

## A. Qualifications:

1. The Contractor must have the capacity and capability of supporting the project by producing schedule-related data within two (2) days of request by the Contractor, Architect, or Owner.

## B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

## C. Meetings:

1. Prescheduling Conference: Scheduled by the Contractor prior to submitting the Baseline Project Schedule, unless otherwise agreed to by the Architect and Owner, for the proper coordination of the work. Conduct conference at Project site. Review methods and procedures related to the Baseline Project Schedule, including, but not limited to, the following:
  - a. Discuss constraints, including **phasing, work stages, area separations, interim milestones** and **partial Owner occupancy**.
  - b. Review delivery dates for Owner-Furnished products.
  - c. Review schedule for work of Owner's separate contracts.
  - d. Review submittal requirements and procedures.
  - e. Review time required for review of submittals and resubmittals.
  - f. Review requirements for test and inspections by independent testing and inspection agencies.
  - g. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
  - h. Review and finalize list of construction activities to be included in schedule.
  - i. Review procedures for updating schedule.
2. Progress Meetings: Scheduled by the Contractor for the proper coordination of the work.
  - a. Weekly Progress Meeting: Schedule on a weekly basis, unless otherwise agreed to by the Architect and Owner;
    - 1) Review Short Interval Schedule.
    - 2) Discuss field observations, problems, and decisions.
  - b. Monthly Schedule Update: Designate a regular monthly meeting to address and resolve all schedule issues for the prior month;
    - 1) Identification of any potential problems which may impede planned progress.
    - 2) Corrective measures to regain projected schedules.
3. Participants (or designated representative) invited to attend each of the above meetings shall be as follows:
  - a. Contractor.
  - b. Owner.
  - c. Architect.
  - d. Project Inspector.
  - e. Installer(s), as appropriate.
  - f. Material Manufacturer(s), as appropriate.
  - g. Subcontractors, as appropriate (including any accessory subcontractors).

## PART 2 - PRODUCTS

## 2.1 GENERAL REQUIREMENTS

- A. Time Frame: Extend schedules from dates established from the Notice to Proceed to final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date.
- B. Activity Data: Schedule to show early start, early finish, late start, late finish, original duration, remaining duration, total float and percentage completion.
  - 1. Contractor shall submit a detailed BPS presenting an orderly and realistic plan for the completion of the entire project.
    - a. The BPS shall not show more than 10% of the total activities as critical.
    - b. The BPS shall not show more than 20% of the activities with total float of 10 working days or less.
    - c. The schedule shall not show any activities with negative float.
    - d. Start and Finish constraints, unless identified in the contract documents, shall be minimized as much as possible.
  - 2. Schedule activities that are dependent on submittal approval and/or material delivery. Activities shall not be scheduled to start earlier than the reasonably expected review, and acceptance or delivery dates.
    - a. Coordinate Submittal Schedule with the list of subcontractors, and the list of products.
    - b. Prepare the schedule in chronological order. Provide information as called for in Specification Section - SUBMITTAL PROCEDURES.
    - c. Submittal Review Time: Include review and resubmittal times indicated in Specification Section - SUBMITTAL PROCEDURES in schedule.
- C. Activity Duration: Activity durations shall be the total number of days required to perform that activity.
  - 1. Define activities so no activity is longer than twenty (20) days, unless specifically allowed by Architect, except for submittal, approval, fabrication and delivery (procurement) activities
  - 2. Activities that require three months or longer to complete, indicate an estimated completion percentage in ten (10) percent increments within the time bar.
  - 3. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than sixty (60) days, as separate activities in schedule.
    - a. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery
  - 4. Startup and Testing Time: Include no fewer than fifteen (15) days for startup and testing.
  - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  - 6. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and final completion.
- D. Constraints:
  - 1. Constraints: Include constraints and work restriction indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
    - a. Phasing: Arrange list of activities on schedule by phase as indicated in Specification Section – SUMMARY OF WORK

- b. Include a Separate activity for each of the following:
    - 1) Work under More Than One Contract.
    - 2) Work Performed By Owner.
    - 3) Each Product Ordered In Advance, include delivery dates.
    - 4) Each Owner-Furnished Product, include the delivery dates.
  - c. Work Restrictions: Show the effect of the following items on the schedule:
    - 1) Coordination with existing construction.
    - 2) Limitations of continued occupancies.
    - 3) Uninterruptible service.
    - 4) Partial occupancy before Substantial Completion.
    - 5) Use of premises restrictions.
    - 6) Provisions for future construction.
    - 7) Seasonal variations.
    - 8) Environmental control.
  - d. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - 1) Submittals.
    - 2) Purchases.
    - 3) Mockups
    - 4) Fabrication
    - 5) Sample Testing.
    - 6) Deliveries
    - 7) Installation
    - 8) Test and inspections
  - e. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities.
- E. Inclement Weather: The schedules shall include delays due to the effect of the anticipated Inclement Weather, including resultant muddy conditions, in all-weather dependent activities.
- 1. The Contractor shall submit with the Baseline Project Schedule, a National Oceanic and Atmospheric Administration (NOAA) Meteorological Data Chart showing the "Normals," "Means," and "Extremes," of monthly Temperature, Precipitation, and Fog for the area where the project is located.
    - a. The Owner reserves the right to update Meteorological Data, so that it reflects the most accurate data for the project site, site conditions and locality.
  - 2. Upon review and acceptance, the Meteorological Data Chart shall be the baseline for evaluating anticipated weather related delays. Refer to the "sample" Meteorological Data Chart provided herein.
    - a. Provide the number of delay days of anticipated Inclement Weather in the schedule per month.
    - b. Provide the number of delay days of anticipated Mud Days in the schedule per month.
      - 1) Not all Mud Days are eligible for delays, only a portion of the actual Mud Days will be considered.
      - 2) Mud Days shall be based on a percentage of actual precipitation days. Upon review and found acceptable, the percentage shall be applied to actual precipitation that are above and beyond the anticipated Inclement Weather.
      - 3) It is the Contractors obligation to become aware of the site soil conditions, drainage patterns, and other elements that may affect the resulting impacts due to Mud Provide.
- F. Project Information:

1. Identification: Include the following Project Identification on all Project Construction Schedules, Coordination Schedules, Schedule Modifications and Time Extension Requests.
  - a. Project Name and Location.
  - b. Name of Owner and Address.
  - c. Name of Architect and Address.
  - d. Architect's Project Number.
  - e. Contractor's Name and Address.
  - f. Submittal Date.

## 2.2 INITIAL PROJECT SCHEDULE (IPS)

### A. Format:

1. Prepare in form of a summary level horizontal-box-column Bar-Chart Schedule:
  - a. Provide and identify separate columns to indicate the following;
    - 1) SPECIFICATION SECTION.
    - 2) DESCRIPTION.
    - 3) RESPONSIBILITY CODE.
    - 4) HORIZONTAL TIME SCALE.
  - b. Provide and identify separate activity line-item horizontal bars to indicate the following;
    - 1) Activity.
    - 2) Milestones.
    - 3) Contract Conditions.

### B. Content:

1. SPECIFICATION SECTION: Use the specification section number in the Project Manual Table of Contents to identify and establish each line-item.
2. DESCRIPTION: Provide a description of the work for each line-item associated with the specification section and responsible party.
3. RESPONSIBILITY CODE: Provide responsibility code that identifies the responsible party for performing the work of each activity line-item associated with the specification section and description.
4. HORIZONTAL TIME SCALE: Identify the week, month and year. Indicate the first work day of each week with a continuous vertical line.
  - a. Extend from the date established from the Notice to Proceed to the date of Final Completion.
5. Activity: Provide a summary level bar chart with distinct graphic delineation for each activity line-item.
  - a. Provide at least one activity line-item for the work in each Specification Section.
    - 1) Provide separate activity line items for each Contractor or Subcontractor providing work under the same specification section.
  - b. Organize activities in chronological order by the beginning of each Activity.
6. Milestones: Include initial milestones with dates for the Notice to Proceed, Project Start, Substantial Completion, and Final Completion.
7. Contract Conditions:
  - a. Identify and provide separate activity line-items that are directly related to Division 01 - GENERAL REQUIREMENTS.
  - b. Identify and provide separate activity line-items that are directly related to Division 00 - CONDITIONS OF THE CONTRACT.



## 2.3 BASELINE PROJECT SCHEDULE (BPS)

## A. Format:

1. Provide a comprehensive, fully developed, detailed, and complete horizontal Gantt-Chart type schedule based on the Initial Project Schedule.
  - a. Provide and identify separate columns to indicate the following:
    - 1) ACTIVITY CODE.
    - 2) SPECIFICATION SECTION.
    - 3) DESCRIPTION.
    - 4) RESPONSIBLE CODE.
    - 5) HORIZONTAL TIME SCALE.
  - b. Provide and identify separate line-item horizontal bars to indicate the following:
    - 1) Activity
    - 2) Sub-Schedules
    - 3) Milestones
    - 4) Contract Conditions

## B. Content:

1. ACTIVITY CODE: Assign Activity Codes that identifies each separate activity line-item to allow the following, but not limited to, to be appropriately sort and grouped into Sub-Schedules, Major Areas of Work, and Reports:
  - a. "construction area," "trade" or "submittal/procurement."
2. SPECIFICATION SECTIONS: As described in the Initial Project Schedule.
3. RESPONSIBLE CODE: As described in the Initial Project Schedule.
4. HORIZONTAL TIME SCALE: As described in the Initial Project Schedule.
5. Activity: As describe in the Initial Project Schedule and expand to provide a detailed level bar chart with distinct graphic delineation for each activity line-item.
  - a. expand to include entities, which are responsible for performing the work of each activity, identified as, but not limited to General Contractor, and Sub-Contractor, second and tertiary tier Sub-Contractors, manufactures, fabricators and vendors.
  - b. Include activities for planned mobilization and sequence of early operations
6. Sub-Schedules: Sub-Schedules shall include, but not be limited to, the following:
  - a. Major Scope of Work: Identify each major area of construction for each major portion of the Work.
    - 1) Include, but not limited to, the following: Phasing, Alternates, Construction Phases and funding Criteria.
  - b. Scope Type: Identify each major area of construction for each major portion of the Work, such as:
    - 1) Site Utilities
    - 2) Site Development Zones
    - 3) Buildings.
      - a) If necessary, separate each floor or separate areas of each main elements of the work.
  - c. Submittals: Include a separate sub-schedule for all submittal, approval and procurement activities, including owner-furnished items.
    - 1) Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - d. Testing and Inspection: Include a separate sub-schedule for all required on-site testing, off-site testing, mock-ups, and inspections.
7. Milestones: As describe in the Initial Project Schedule and include other milestones indicated in the Contract Documents and the following interim milestones.
  - a. Earthwork.

- b. Building Foundations and slab on grade.
  - c. Structural completions.
  - d. Partial Occupancy before Substantial Completion.
  - e. Temporary Enclosure and Space Conditioning.
  - f. Permanent Space enclosure.
  - g. Completion of Mechanical.
  - h. Completion of Electrical Installation.
  - i. Completion of Communication Installation.
  - j. Substantial Completion
  - k. Final Completion
8. Contract Conditions: As described in the Initial Project Schedule and expanded to include separate activity line-items that are directly related to Division 01 - General Requirements and are not of actual work-in-place. Such items shall be, but not limited to the following.
- a. Temporary Facilities.
  - b. Field Engineering.
  - c. Project Closeout Requirements:
    - 1) Startup and Testing Time:
    - 2) Operation and Maintenance.
    - 3) Demonstration and Training.
    - 4) Punch List.

### PART 3 - EXECUTION

#### 3.1 SCHEDULES AND PROCEDURES FOR CONSTRUCTION SCHEDULES

##### A. General Requirements:

- 1. The Architect may request the Contractor to provide (at no cost) the following additional reports or schedule plots:
  - a. Total or Free Float Report from least to most float.
  - b. Subcontractor Certifications, indicating approval of the subcontractors scheduled work, acknowledging outside factors such as manpower resources, stacking of trades, multiple mobilizations, and coordination of space with other trades and the stacking of trades.
  - c. Narrative Reports: May include but not limited to the following descriptions;
    - 1) Last month's progress achieved, and anticipated next month's progress.
    - 2) Problems or delays experienced and an explanation of mitigating actions taken.
    - 3) Current or anticipated delays and proposed mitigation action to be taken.
    - 4) Listing of all submittals, RFIs, Change Directives, Owner-supplied equipment or other Owner-controlled and critical constraints affecting the Contractor's progress.

##### B. Coordination Schedules:

- 1. Short Interval Schedules (SIS): A look-ahead schedule.
  - a. Provide a three-week snapshot of the work generated from the most recent monthly Schedule Update.
  - b. Include the current week, and two week thereafter.
  - c. The schedule shall contain sufficient detail to evaluate inspection requirements, and for the Contractor to anticipate manpower and equipment needs.
- 2. Monthly Schedule Updates (MSU): Accurately indicate the actual progress of the work during the prior month.

- a. Indicate the date through which progress is reported shall be identified on all update schedule.
    - 1) Provide the actual start and finish dates of activities commenced or completed during the prior month.
    - 2) Once the actual start and finish dates are updated and accepted as accurate, this data shall not be changed. This portion shall be considered an "As-Built."
    - 3) If the schedule data is changed due to a routine updating only, no identification or discussion of such changes is required.
  - b. The Monthly Schedule Updates shall include the Schedule Modifications and Time Extensions that have been mutual agreed to by the Architect and Contractor.
    - 1) In the event of multiple Schedule Modifications and Time Extensions, events shall be updated into the current Monthly Schedule Update in the actual order of occurrence.
  - c. The Architect's review comments shall be incorporated into the next update for the Architect's verification.
- C. Schedule Modifications:
- 1. Changes in Sequence:
    - a. If the Architect determines that the sequence of the construction differs significantly from the Contract schedule, the Contractor shall submit a revised schedule for approval within fourteen (14) days of the Architect's request.
    - b. If the work is re-sequenced, or if activities are added or deleted, these schedule data changes must be specifically identified, discussed and submitted.
      - 1) The submittal shall be separate and apart from the routine monthly update submittals.
    - c. If the changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.
      - 1) The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.
  - 2. Recovery Schedule:
    - a. When periodic update indicates, the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indication means by which Contractor intends to regain compliance with the schedule.
    - b. Submittal shall indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
      - 1) The submittal shall be separate and apart from routine monthly update submittals.
    - c. The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.
  - 3. Alterations to Schedule:
    - a. If the Contractor intends to alter its planned sequence or approach to the work, the Contractor shall submit a request of the schedule revisions or sequence changes to the Architect for review and comment.
    - b. Submittal shall include a description of the reason(s) for the schedule changes, a description of the changes being made, a list of all added and deleted activities, changed logic relationships, changed activity durations or descriptions, etc.
      - 1) The submittal shall be separate and apart from routine monthly update submittals.

- c. If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.
  - 1) The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.
- D. Time Extension Submittals:
  - 1. Notice of Delay:
    - a. Provide "Notice of Delay" submittal to the Architect for all claimed time extension requests, showing the impact of the delay event on the Project Schedule. Refer to the "sample" "Notice of Delay" form provided herein.
      - 1) Submit as a Change Order Request (COR) in response to an event, SI, RFI, RFP, or other documents issued by the Architect.
      - 2) In cases where the Contractor does not provide "Notice of Delay" submittal for a delay event within the specified time limits, then it is mutually agreed that the delay event has no time impact on the contract completion date (or interim milestones) and no time extension is required
    - b. The Submittal shall demonstrate the time impact based on the date(s) and durations of the delay event, the status of construction at that point in time, and the affect on the scheduled sequence, progress of the Critical Path Activities and Project Completion.
      - 1) The Submittal shall be based on the latest Monthly Schedule Update.
      - 2) The Submittal shall include all supporting project documentation or delay calculations that establish entitlement and quantify the delay.
      - 3) The Submittal shall demonstrate the activity or activities effects on the total float along the activity path at the time the event occurred.
      - 4) The Contractor must propose possible mitigation plans (sequence changes and any costs) for otherwise critical path delays.
        - a) The Contractor shall provide an evaluation of the cost of mitigation versus the cost of extended project performance.
    - c. If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.
      - 1) Extensions of time for performance will be granted only to the extent that the equitable time adjustment for the activity or activities affected exceeds the total float.
      - 2) The Contractor acknowledges and agrees that mitigation of delays due to delay events may require a change to preferential sequences of work.
        - a) The Contractor agrees to be bound by the revised, re-sequenced or optimized schedules, and agrees to make no claim for such.
    - d. The Owner (or District) shall not be liable for any acceleration costs due to the Contractor's failure to comply with the contract requirements for requesting, documenting and demonstrating that a time extension is required for a delay event.
      - 1) The Contractor's obligation to timely perform per the schedule will not be excused until time extension requests are reviewed and accepted by the Architect.
  - 2. Inclement Weather Delays:
    - a. General:
      - 1) The Contractor shall record on the Contractor Daily Reports, each occurrence of Inclement Weather and Mud impacts to the progress of scheduled work through the Contract duration.

## CONSTRUCTION SCHEDULES

2175

- a) Inclement Weather days will be counted chronologically from the first to the last day of each month, with each daily incidence of "Inclement Weather" being counted as a whole day.
  - b) Each occurrence of Inclement Weather and Mud, must be verified and approved by the Inspector of Record.
- b. Unusually Severe Weather:
- 1) Provide "Unusually Severe Weathersubmittal to the Architect for all claimed time extension requests, showing the impact of the delay event on the contract schedule. Refer to the "sample" "Notice of Unusually Severe Weather" form provided herein.
  - 2) Submit as a Change Order Request (COR).
  - 3) The submittal shall demonstrate the time impact based on the date(s) and durations of the delay event, the status of construction at that point in time, and the effect on the scheduled sequence and progress of the Critical Path Activities.
    - a) The submittal shall be based on the latest Monthly Schedule Update.
    - b) The submittal shall include all supporting project documentation or delay calculations that establish entitlement and quantify the number of days of anticipated "Inclement Weather" are exceeded in a given month.
    - c) The submittal shall demonstrate the effects on the total float of the Project at the time the event occurred
    - d) The submittal shall demonstrate that the delay must be beyond the control and without the fault of negligence of the Contractor
  - 4) If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update submittal.
    - a) The Contractor will become eligible for an excusable, non-compensable time extension for "Unusually Severe Weather."
- c. Mud Days:
- 1) Provide "Mud Days" Submittal to the Architect for all claimed time extension requests, showing the impact of the delay event on the contract schedule. Refer to the "sample" "Notice of Mud Days" form provided herein
  - 2) Submit as a Change Order Request (COR).
  - 3) The Submittal shall demonstrate the time impact based on the date(s) and durations of the delay event, the status of construction at that point in time, and the effect on the scheduled sequence and progress of the Critical Path Activities.
    - a) The Submittal shall be based on the latest Monthly Schedule Update.
    - b) The Submittal shall include all supporting project documentation or delay calculations that establish entitlement and quantify the number of days of anticipated "Mud Days" are exceeded in a given month.
    - c) The Submittal shall demonstrate the effects on the total float of the Project at the time the event occurred.
    - d) The Submittal shall demonstrate that the delay must be beyond the control and without the fault of negligence of the Contractor.
  - 4) If the requested changes are reviewed and found acceptable, the schedule revision shall be made and incorporated into the project schedule prior to the next Monthly Schedule Update Submittal.
    - a) The Contractor will become eligible for an excusable, non-compensable time extension for "Mud Days."

**3.2 SCHEDULES****A. List of attached Forms and Reports.**

1. Meteorological Data Chart.
2. Notice of Delay Form.
3. Inclement Weather Form.

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<b>EXAMPLE</b> Meteorological Data for Fresno, California Normals, Means and Extremes							
<b>TEMPERATURE (degrees F)</b>					<b>PRECIPITATION***</b>		<b>FOG</b>
	<b>Normal</b>		<b>Extremes</b>				
<b>Month</b>	<b>Daily Max.</b>	<b>Daily Min.</b>	<b>Record Highest</b>	<b>Record Lowest</b>	<b>Mean* Number Calendar / Work</b>	<b>Normal (in)</b>	<b>Mean** Number Calendar / Work</b>
					<b>Days per Month</b>		<b>Days per Month</b>
Jan	54.1	37.4	78	19	7.5/5.4	1.96	11.8/8.4
Feb	61.7	40.5	80	24	7.1/5.1	1.8	6.0/4.3
Mar	66.6	43.4	90	26	7.1/5.1	1.89	1.7/1.2
Apr	75.1	47.3	100	32	4.1/2.9	0.97	0.3/0.2
May	84.2	53.7	107	36	1.9/1.4	0.3	0.1/0.1
Jun	92.7	60.4	110	44	0.7/0.5	0.08	0.0/0.0
Jul	98.6	65.1	112	50	0.2/0.1	0.01	0.0/0.0
Aug	96.7	63.8	111	49	0.3/0.2	0.03	0.1/0.1
Sep	90.1	58.8	111	37	1.0/0.7	0.24	0.1/0.1
Oct	79.7	50.7	102	27	2.2/1.6	0.53	0.9/0.6
Nov	64.7	42.5	89	26	5.2/3.7	1.37	5.8/4.1
Dec	53.7	37.1	76	18	6.7/4.8	1.42	12.1/8.6
Year					44.1/31.5	10.6	38.8/27.7
Source: NOAA, National Oceanic and Atmosphere Administration.							
* Precipitation of 0.01 inches or more.							
** Heavy Fog visibility 1/4 mile or less.							
*** Refer to the term Mud, for mud impacts.							
Above data is subject to change, based upon the locality of the project. Contractor shall assemble the data and submit to The Architect for confirmation, review and modifications: Obtain data from NOAA (828) 271-4800, or the Local Weather Office. <a href="http://www.ncdc.noaa.gov">http://www.ncdc.noaa.gov</a>							

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**CONSTRUCTION SCHEDULES**  
**NOTICE OF DELAY FORM**

2175

Date: \_\_\_\_\_ Submittal No.: \_\_\_\_\_  
From: Name of Contractor \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_  
To: Darden Architects, 6790 N. West Avenue, Fresno, CA 93711 (559) 448-8051  
Description of Delay: By reference to attached schedule, the following delay occurred:

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Continued on Sheets \_\_\_\_ of \_\_\_\_  
Time Extension Requested: \_\_\_\_\_ work days x 1.4 = \_\_\_\_\_ calendar days.

Time Requested for Activity: \_\_\_\_\_ Time Requested for Project: \_\_\_\_\_

Related Documents: The following construction documents provide evidence of the delay event:

RFI Nos.: \_\_\_\_\_ SI Nos.: \_\_\_\_\_

CCD Nos.: \_\_\_\_\_ RFP Nos.: \_\_\_\_\_

Daily Reports Dated: \_\_\_\_\_ and attached.

Project Correspondence Dated: \_\_\_\_\_ and attached.

Other Documentation: \_\_\_\_\_

Schedule-Related Information: By reference to the attached Schedule, provide the following:

Predecessor Activity: \_\_\_\_\_

Successor Activity: \_\_\_\_\_

Affected CPM Schedule Activities (list IDs and descriptions):

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**CONSTRUCTION SCHEDULES  
INCLEMENT WEATHER FORM**

2175

Date: \_\_\_\_\_

From: Name of Contractor \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_

To: Darden Architects, 6790 N. West Avenue, Fresno, CA 93711 (559) 448-8051

Description of Delay: the following delay occurred:

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Continued on Sheets \_\_\_\_ of \_\_\_\_  
Time Extension Requested: \_\_\_\_\_ work days x 1.4 = \_\_\_\_\_ calendar days.

Time Requested for Activity: \_\_\_\_\_ Time Requested for Project: \_\_\_\_\_

Related Documents: The following construction documents provide evidence of the delay event:

Daily Reports Dated: \_\_\_\_\_ and attached.

Project Correspondence Dated: \_\_\_\_\_ and attached.

Other Documentation: \_\_\_\_\_

Affected CPM Schedule Activities (list IDs and descriptions):

---

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END OF SECTION

## SECTION 01 32 26 – FORMS AND REPORTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Contractor to provide all Forms and Reports as required by the Architect for Administrative Procedures and other related items necessary to document the Project as required by the Contract Documents, including but not limited to those forms provided under this specification section.
  - 2. CalGREEN Forms:
    - a. Contractor shall provide all California Green Building Standards Code Certification Worksheets and other related items necessary to document the Project as required by the AHJ, including, but not limited to, those forms provided under this specification section.
      - 1) Obtain the latest documents from the California Building Standards Commission; revisions may have been made since the publication of this Project Manual.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS
  - 2. DIVISION 01 SPECIFICATION SECTIONS
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Forms and Reports as attached to this section when required by the Architect.

## 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

## PART 2 - PRODUCTS

NOT APPLICABLE

## PART 3 - EXECUTION

## 3.1 SCHEDULES

- A. Listing of Architect required Forms and Reports
  - 1. 01 32 26.01-DAILY SUPERINTENDENT'S REPORT
  - 2. 01 32 26.02-SUBCONTRACTOR'S DAILY REPORT

3. 01 32 26.03-SHOP DRAWING AND SUBMITTAL TRANSMITTAL
  4. 01 32 26.04-REQUEST FOR INFORMATION (RFI)
  5. 01 32 26.05-SUPPLEMENTAL INSTRUCTIONS (SI)
  6. 01 32 26.06-REQUEST FOR PROPOSAL (RFP)
  7. 01 32 26.07-CONSTRUCTION CHANGE DIRECTIVE (CCD)
  8. 01 32 26.08-CHANGE ORDER REQUEST REVIEW (COR)
    - a. (Review form provided by the Contractor is subject to review and comments by the Owner and Architect).
  9. 01 32 26.09-CHANGE ORDER (CO)
  10. 01 32 26.10-FRAGNET SUBMITTAL FORM
  11. 01 32 26.11-APPLICATION FOR PAYMENT (AP)
  12. 01 32 26.12-CONTRACTOR'S TESTING / INSPECTION REQUEST FORM
  13. 01 32 26.13-CONTRACTOR'S "DEVIATION NOTICE" INSPECTION REPORT FORM
  14. 01 32 26.14-CONTRACTOR'S FINAL INSPECTION REQUEST FORM
  15. 01 32 26.15-CONTRACTOR'S PUNCHLIST INSPECTION REQUEST FORM
  16. 01 32 26.16-CONTRACTOR'S PUNCHLIST
  17. Periodic field reports issued by the Architect and Engineers.
  18. Contractor's Punch List Response and Correction form is required for each Punch List Review report, citing the issuing Punch List Review format number(s).
  19. Completed Contractor's Punch List and Final Inspection Reports issued by the Architect, Engineers and the Owner.
  20. See the attached Forms and Reports suitable for reproduction by the Contractor or Subcontractor.
- B. Listing of California Green Building Standards Code Certification Worksheets:
1. WORKSHEET (WS-1) BASELINE WATER USE
  2. WORKSHEET (WS-2) WATER USE REDUCTION
  3. CONSTRUCTION WASTE MANAGEMENT (CWM) PLAN
  4. CONSTRUCTION WASTE MANAGEMENT (CWM) WORKSHEET
  5. CONSTRUCTION WASTE MANAGEMENT (CWM) ACKNOWLEDGMENT
- END OF SECTION

**GENERAL CONTRACTOR'S  
DAILY SUPERINTENDENT'S REPORT**

(JOB NO./REPORT NO.)

(DATE/DAY)

(JOB NAME)

WEATHER DESCRIPTION

(WORK SHIFT) / FROM / TO

(PROJECT MANAGER/SUPERINTENDENT)

PM/ SUPT	ENGR/ TK	CARPENTERS			LABORERS		CEM FINISHERS			OPER ENGR		OTHER	TOTAL
		FMAN	JRMAN	APP	FMAN	LAB	FMAN	JRMAN	APP	JRMAN	APP		

CONCRETE: CY TODAY: LOCATION: CY TO DATE:

WORK SUMMARY:

DELAYS / WORK RELEASED BY OWNER:

CHANGE ORDERS / EXTRA WORK ORDERS:

INSTRUCTIONS FROM ARCHITECT / OWNER:

MATERIALS / EQUIP. DELIVERED TO JOB:

INSPECTIONS / TESTS PERFORMED

SAFETY / ACCIDENTS:

MAJOR EQUIP. ON SITE:

### BACKSIDE OF GENERAL CONTRACTOR'S REPORT

[illegible]

MAJOR EQUIPMENT ON SITE:

BACK CHARGES:

REMARKS:

**SUBCONTRACTOR'S  
DAILY REPORT**

PROJECT:

DATE:

SHIFT TIME

FOREMAN:

WEATHER:

WORK DESCRIPTION AND LOCATION:

SUB-SUBCONTRACTOR	CREW SIZE	CRAFT	WORK DESCRIPTION / LOCATION

DELAYS:

CHANGE ORDERS / EXTRA WORK ORDERS:

INSTRUCTIONS RECEIVED FROM GC:

TESTS / INSPECTIONS PERFORMED:

MATERIAL / EQUIPMENT DELIVERIES:

MAJOR EQUIPMENT ON SITE:

SAFETY / ACCIDENTS:

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# SHOP DRAWING AND SUBMITTAL TRANSMITTAL

**DESCRIPTION:**

**SUBMITTAL NO.:**

**SPEC SECTION:**

**ARCHITECT:**

**Darden Architects**

6790 N. West Ave

Fresno, California 93711

**PROJECT:**

**CONTRACTOR:**

**SUPPLIER:**

**Substitution:** Yes: ☐ DSA Approval Req'd

**DATE RECEIVED:** \_\_\_\_\_ **NO. RECEIVED:** \_\_\_\_\_ **DATE RETURNED:** \_\_\_\_\_

**Contractor Remarks:**

**Other Required Information:**

CPM Activity / Submittal Task No.: \_\_\_\_\_

Early Start (ES) Date: \_\_\_\_\_

Late Finish (LF) Date: \_\_\_\_\_

**WARRANTY:** ☐ O and M MANUALS ☐

Early Finish (EF) Date: \_\_\_\_\_

Scheduled Float Time: \_\_\_\_\_ 0

**DESIGN CONSULTANT'S REVIEW:**

TRANSMITTED BY ARCHITECT TO: \_\_\_\_\_ DATE RETURNED: \_\_\_\_\_

DATE SENT: \_\_\_\_\_

NO. SENT: \_\_\_\_\_

**Consultants Remarks:**

**ACTION:**

- ☐ NO EXCEPTION TAKEN RELATIVE TO DESIGN
- ☐ NO EXCEPTION TAKEN WITH MODIFICATION NOTED
- ☐ AMEND AS NOTED AND RESUBMIT
- ☐ REJECTED AND RESUBMIT
- ☐ SEE ATTACHED LETTER

**ARCHITECT'S REVIEW:**

**Architects Remarks:**

**ACTION:**

- ☐ NO EXCEPTION TAKEN RELATIVE TO DESIGN
- ☐ NO EXCEPTION TAKEN WITH MODIFICATION NOTED
- ☐ AMEND AS NOTED AND RESUBMIT
- ☐ REJECTED AND RESUBMIT

**Approved Substitution** ☐

**COPIES TO:**

**DATE RETURNED:** \_\_\_\_\_

**Contractor:**

**Owner:**

**Inspector:**

**File:**

**Other:**



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6790 N. West Avenue  
Fresno, California 93711  
Tel: 559.448.8051  
Fax: 559.446.1765

[www.dardenarchitects.com](http://www.dardenarchitects.com)

## REQUEST FOR INFORMATION

RFI No.:

To: **Darden Architects**  
6790 N. West Ave  
Fresno, California 93711

Date:  
Respond By:

Attn:

Architect Project No.  
Project:

DSA/HCAI Review  
Required

Yes No Apprd  
☐ ☐ ☐

### INFORMATION REQUESTED:

Cost Impact: \_\_\_\_\_ Signature: \_\_\_\_\_  
Schedule Impact: \_\_\_\_\_ Days Pages Attached: \_\_\_\_\_  
Trade/Contractor: \_\_\_\_\_ Schedule Task No/Item: \_\_\_\_\_

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in the Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time.

If the Contractor considers that this supplemental instruction requires a change in the Contract Sum or Contract Time, the Contractor shall not proceed with this Work and shall promptly submit an itemized proposal to the Architect for doing this work. If your proposal is found to be satisfactory and in order, this supplemental instruction will be superseded by a Construction Change Directive.

Referred To: \_\_\_\_\_ Referred Date: \_\_\_\_\_ Return Date: \_\_\_\_\_

### SUPPLEMENTAL INSTRUCTIONS:

Consultant : \_\_\_\_\_ Architect \_\_\_\_\_  
Date: \_\_\_\_\_ Date \_\_\_\_\_

Copy: ☐ Owner ☐ Inspector ☐ Testing Lab ☐ Structural ☐ Mech. ☐ Elec ☐ File ☐ Other Pages Attached: \_\_\_\_\_

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## SUPPLEMENTAL INSTRUCTIONS

**PROJECT:**

**SUPPL. INST. NO.:**

**DATE OF ISSUANCE:**

**OWNER:**

**CONTRACT DATE:**

**NOTICE TO PROCEED:**

**CONTRACTOR:**

Architect Project No.:

DSA Appl. No.:

DSA File No.:

OPSC Appl. No.:

HCAI No.:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in the Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgement that there will be no change in the Contract Sum or Contract Time.

If the Contractor considers that this supplemental instruction requires a change in the Contract Sum or Contract Time, the Contractor shall not proceed with this Work and shall promptly submit an itemized proposal to the Architect for doing this work. If your proposal is found to be satisfactory and in order, this supplemental instruction will be superseded by a Construction Change Directive.

**Description:**

Trade/Contractor:

Schedule Task No/Item:

**Attachments:**

**Darden Architects, Inc.**

Issued By:

\_\_\_\_\_  
Architect

☐ OWNER ☐ CONTRACTOR ☐ INSPECTOR ☐ TESTING LAB ☐ STRUCTURAL ☐ MECHANICAL ☐ ELECTRICAL ☐ OTHER

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## REQUEST FOR PROPOSAL

**PROJECT:**

**REQUEST FOR PROPOSAL NO.:**

**DATE OF ISSUANCE:**

**OWNER:**

**CONTRACT DATE:**

**NOTICE TO PROCEED:**

**CONTRACTOR:**

Architect Project No.:

DSA Appl. No.:

DSA File No.:

OPSC Appl. No.:

HCAI No.:

---

Please submit an itemized proposal for change in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Submit proposal promptly or notify the Architect in writing of the date on which you anticipate submitting your proposal.

This is not a Change Order, Construction Change Directive, or a direction to proceed with the Work described in the proposed modifications.

---

**Description:**

**Attachments**

**Darden Architects, Inc.**

---

**ISSUED BY:**

---

**Architect**

☐ OWNER   ☐ CONTRACTOR   ☐ ARCHITECT   ☐ CONSULTANT   ☐ INSPECTOR   ☐ OTHER

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## CONSTRUCTION CHANGE DIRECTIVE

**PROJECT:**

**DIRECTIVE NO.:**

**DATE OF ISSUANCE:**

**OWNER:**

**CONTRACT DATE:**

**NOTICE TO PROCEED:**

**CONTRACTOR:**

Architect Project No.:

DSA Appl. No.:

DSA File No.:

OPSC Appl. No.:

HCAI No.:

You are hereby directed to make the following change(s) in this Contract:

### CONTRACT ADJUSTMENT

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

- ☐ Lump Sum  
☐ Unit Price of  
☐ As provided for in General Conditions and the Supplemental Conditions of the contract.  
☐ As Follows:

2. The Contract Time is proposed to (be adjusted) . The proposed adjustment, if any, is increase of \_\_\_\_\_ days)

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Signature by the Contractor indicates the Contractor's agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this Construction Change Directive.

ARCHITECT

OWNER

CONTRACTOR

Darden Architects

6790 N. West Ave

Fresno, California 93711

By:

By:

By:

Date:

Date:

Date:

☐ OWNER

☐ CONTRACTOR

☐ ARCHITECT

☐ CONSULTANT

☐ INSPECTOR

☐ OTHER



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6790 N. West Ave

Fresno, California 93711

Tel: 559.448.8051

Fax: 559.446.1765

www.dardenarchitects.com

## CHANGE ORDER REQUEST REVIEW

PROJECT:

CHANGE ORDER REQUEST NO.:

DATE OF ISSUANCE:

OWNER:

CONTRACTOR:

Architect Project No.:

DSA Appl. No.:

DSA File No.:

OPSC Appl. No.:

HCAI No.:

DESCRIPTION OF PROPOSED CHANGE:

Requested By:

Scope:

Necessary for:

DESIGN CONSULTANT'S REVIEW:

Date Sent:

ACTION:

Referred To:

Date Returned:

- ☐ NO EXCEPTION TAKEN RELATIVE TO COST  
☐ NO EXCEPTION TAKEN RELATIVE TO TIME  
☐ AMEND AS NOTED AND RESUBMIT  
☐ REJECTED

Consultants Remarks

ARCHITECT'S REVIEW:

Date Returned:

ACTION:

Architects Remarks:

- ☐ NO EXCEPTION TAKEN RELATIVE TO COST  
☐ NO EXCEPTION TAKEN RELATIVE TO TIME  
☐ AMEND AS NOTED AND RESUBMIT  
☐ REJECTED

Attachments:

REVIEWED:

Darden Architects  
6790 N. West Ave  
Fresno, California 93711

APPROVED:

Darden Architects :

Date :

Owner :

Date :

The Architect is hereby directed to instruct the Contractor to make the above changes in the Project and to include these changes in a subsequent Change Order:

☐ OWNER ☐ CONTRACTOR ☐ INSPECTOR ☐ STRUCTURAL ☐ MECHANICAL ☐ ELECTRICAL ☐ OTHER

CHANGE ORDER REQUEST NO.

Project Architect's Project No.:

## CHANGE ORDER REQUEST- BREAKDOWN WORKSHEET

### WORK DELETED:

Contractor			
Materials	\$0.00		
Equipment	\$0.00		
Labor	\$0.00		
Material, Equipment, & Labor	\$0.00		
TOTAL:			<b>\$0.00</b>

### ADDITIONAL WORK PERFORMED BY SUB-CONTRACTOR

Sub-Contractor			
Materials	\$0.00		
Equipment	\$0.00		
Labor	\$0.00		
Material, Equipment, & Labor	\$0.00		
Overhead	\$0.00		
Profit	\$0.00		
Sub Total:		\$0.00	
Contractor			
Overhead		\$0.00	
Profit		\$0.00	
TOTAL:			<b>\$0.00</b>

### ADDITIONAL WORK PERFORMED BY CONTRACTOR

Contractor			
Materials	\$0.00		
Equipment	\$0.00		
Labor	\$0.00		
Material, Equipment, & Labor	\$0.00		
Overhead	\$0.00		
Profit	\$0.00		
TOTAL:			<b>\$0.00</b>

<b>TOTAL COST:</b>	<b>\$0.00</b>
--------------------	---------------

---

TOTAL COST:	\$0.00
-------------	--------

TOTAL DAYS:	0
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### ARCHITECTURAL ADMINISTRATIVE FEES:

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Proposal Request Administration	\$0.00
Construction Administration	\$0.00
TOTAL:	\$0.00
DSA Fees:	\$0.00

---

## CHANGE ORDER

**PROJECT:**

**CHANGE ORDER NO.:**

**DATE OF ISSUANCE:**

**OWNER:**

**CONTRACT DATE:**

**CONTRACTOR:**

**NOTICE TO PROCEED:**

Architect Project No.:  
DSA Appl. No.:  
DSA File No.:  
OPSC Appl. No.:  
HCAI No.:

The Contract is changed as follows:

**Description:**

It is mutually agreed that the affixed signature to this Change Order is evidence that all compensation with respects to the changes defined herein have been satisfied with the execution of this document. Furthermore, no additional compensation either monetarily or via time extension to this contract will be sought in respect to this Change Order.

The Original Contract Sum and Contract Completion Date:

Net change (Contract Sum and Contract Time) by previous Change Orders: \_\_\_\_\_ days

Contract Sum and Contract Completion Date prior to this Change Order: \_\_\_\_\_

Contract Sum and Contract Time (increased or decreased) by this Change Order: \_\_\_\_\_ days

New Contract Sum and Contract Completion Date including this Change Order: \_\_\_\_\_

**CONTRACTOR**

**ARCHITECT**

**OWNER**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Darden Architects  
6790 N. West Ave  
Fresno, California 93711

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

☐ OWNER ☐ CONTRACTOR ☐ ARCHITECT ☐ CONSULTANT ☐ INSPECTOR ☐ OTHER

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FRAGNET SUBMITTAL FORM

Date: \_\_\_\_\_

Sheet \_\_\_\_\_ of \_\_\_\_\_

From: \_\_\_\_\_

Fragnet No.: \_\_\_\_\_

To: Darden Architects, Inc.

Description of Delay: By reference to attached schedule fragnet, the following delay occurred:

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---

---

Continued on Sheets \_\_\_\_\_ of \_\_\_\_\_  
Time Extension Requested: \_\_\_\_\_ wds, \_\_\_\_\_ cds.  
Time Requested for Activity: \_\_\_\_\_ Time Requested for Project: \_\_\_\_\_

Related Documents: The following construction documents provide evidence of the delay event:

RFI Nos.: \_\_\_\_\_ SI Nos.: \_\_\_\_\_

CCD Nos: \_\_\_\_\_ RFP Nos.: \_\_\_\_\_

Daily Reports Dated: \_\_\_\_\_ and attached.

Project Correspondence Dated: \_\_\_\_\_ and attached.

Other Documentation: \_\_\_\_\_

Schedule-Related Information: By reference to the attached fragnet, provide the following:

Predecessor Activity to Fragnet:

Successor Activity to Fragnet:

Affected CPM Schedule Activities (list IDs and descriptions):

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New CPM Schedule Activities (list IDs and descriptions):

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END OF FORM

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**APPLICATION FOR PAYMENT**

To:  
**DARDEN ARCHITECTS, INC.**  
**6790 N. West Avenue**  
**Fresno, CA 93711**

Project: \_\_\_\_\_

Pay Application No.: \_\_\_\_\_

Distribution to:

Owner: \_\_\_\_\_

Architect: \_\_\_\_\_

Contractor: \_\_\_\_\_

Const Mgr.: \_\_\_\_\_

Inspector: \_\_\_\_\_

Bid Package No. \_\_\_\_\_

Application Date: \_\_\_\_\_

Period Ending: \_\_\_\_\_

FROM \_\_\_\_\_

Prime Contractor

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

**CONTRACTOR'S APPLICATION FOR PAYMENT****CHANGE ORDER SUMMARY****APPROVED CHANGE ORDERS:**

Change Order No.:	Approved Date:	Amount:
		\$
		\$
		\$
		\$
		\$
		\$
		\$
		\$
		\$

**TOTALS**

Net change by Change Order	\$
----------------------------	----

The undersigned Contractor certifies that in the best of his knowledge, information, and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the contractor for work for which previous Certificates for Payment were issued and payment received from the Owner and that current payment show herein is now due.

**Contractor:** \_\_\_\_\_**DATE:** \_\_\_\_\_

The present status of the account for this Contract is as follows:

ORIGINAL CONTRACT SUM \$ \_\_\_\_\_

Net Change by Change Orders \$ \_\_\_\_\_

CONTRACT SUM TO DATE: \$ \_\_\_\_\_

TOTAL COMPLETE &amp; STORED TO DATE: \$ \_\_\_\_\_

RETAINAGE: \_\_\_\_\_ %: \$ \_\_\_\_\_

TOTAL EARNED LESS RETAINAGE: \$ \_\_\_\_\_

LESS STOP NOTICE(S): \$ \_\_\_\_\_

LESS PREVIOUS PAYMENT: \$ \_\_\_\_\_

CURRENT PAYMENT DUE: \$ \_\_\_\_\_

This Certificate is not negotiable. This AMOUNT CERTIFIED is payable only to the Contractor named herein, issuance, payment and acceptance of payment, are without prejudice to any rights of the Owner or Contractor under this contract.

CONTRACTOR: \_\_\_\_\_

DATE: \_\_\_\_\_

CONSTRUCTION MANAGER: \_\_\_\_\_

DATE: \_\_\_\_\_

INSPECTOR: \_\_\_\_\_

DATE: \_\_\_\_\_

ARCHITECT: \_\_\_\_\_

DATE: \_\_\_\_\_



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CONTRACTOR'S TESTING / INSPECTION REQUEST FORM

PROJECT: \_\_\_\_\_  
DATE RECEIVED: \_\_\_\_\_ (by Inspector)  
TIME RECEIVED: \_\_\_\_\_ (by Inspector)  
  
BUILDING: \_\_\_\_\_  
SITE/OFFSITE: \_\_\_\_\_  
CONSTRUCTION PHASE (1, 2, 3, etc.): \_\_\_\_\_  
SPECIFICATION SECTION (No.): \_\_\_\_\_  
PLAN SHEET AND DETAIL: \_\_\_\_\_  
SCOPE OF WORK: \_\_\_\_\_  
(concrete, electrical, etc.)

INSPECTION REQUESTED BY: \_\_\_\_\_  
(contractor name)

LOCATION (bldg., room, floor, wall, ceiling, etc.) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TYPE OF INSPECTION (concrete, framing, welding, masonry, electrical, etc.) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

INSPECTION REQUESTED ON: \_\_\_\_\_ at \_\_\_\_\_ am/pm  
(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the Testing / Inspection is Requested to Begin.

\_\_\_\_\_  
PRINT NAME AND TITLE OF PERSON REQUESTING INSPECTION

\_\_\_\_\_  
SIGNATURE OF PERSON REQUESTING INSPECTION

Note 2: Contractor Must Accompany Inspector on Inspection, if Requested.

PASSED: \_\_\_\_\_ FAILED: \_\_\_\_\_

Note 3: See Attached Sheet for Explanation if Inspection Failed. Re-inspection Required.

INSPECTOR SIGNATURE: \_\_\_\_\_ Date: \_\_\_\_\_

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CONTRACTOR'S "DEVIATION NOTICE" INSPECTION REQUEST FORM

PROJECT: \_\_\_\_\_  
DATE RECEIVED: \_\_\_\_\_ (by Inspector)  
TIME RECEIVED: \_\_\_\_\_ (by Inspector)

DEVIATION NOTICE(S) (No.): \_\_\_\_\_

BUILDING: \_\_\_\_\_  
SITE/OFFSITE: \_\_\_\_\_  
CONSTRUCTION PHASE (1, 2, 3, etc.): \_\_\_\_\_  
SPECIFICATION SECTION (No.): \_\_\_\_\_  
SCOPE OF WORK: \_\_\_\_\_  
(concrete, electrical, etc.)

INSPECTION REQUESTED BY: \_\_\_\_\_  
(contractor company name)

LOCATION(S) OF WORK FOR INSPECTION (be specific- bldg.(s), room(s), etc.)  
\_\_\_\_\_  
\_\_\_\_\_

INSPECTION REQUESTED ON: \_\_\_\_\_ at \_\_\_\_\_ am/pm  
(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the "Deviation Notice" Inspection is Requested to Begin.

\_\_\_\_\_  
PRINT NAME OF PERSON REQUESTING DEVIATION NOTICE INSPECTION

\_\_\_\_\_  
SIGNATURE OF PERSON REQUESTING DEVIATION NOTICE INSPECTION

Note 2: Contractor Must Accompany Project Inspector on "Deviation Notice" Inspection, if Requested.

Note 3: See Attached "Deviation Notice" for Inspector's Comments and/or Date Completed.

PASSED: \_\_\_\_\_ FAILED: \_\_\_\_\_

PROJECT INSPECTOR SIGNATURE: \_\_\_\_\_  
DATE: \_\_\_\_\_

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CONTRACTOR'S FINAL INSPECTION REQUEST FORM

PROJECT: \_\_\_\_\_  
DATE RECEIVED: \_\_\_\_\_ (by Inspector)  
TIME RECEIVED: \_\_\_\_\_ (by Inspector)  
  
BUILDING: \_\_\_\_\_  
SITE/OFFSITE: \_\_\_\_\_  
CONSTRUCTION PHASE (1, 2, 3, etc.): \_\_\_\_\_  
SPECIFICATION SECTION (No.): \_\_\_\_\_  
SCOPE OF WORK: \_\_\_\_\_  
(concrete, electrical, etc.)

INSPECTION REQUESTED BY: \_\_\_\_\_  
(contractor company name)

INSPECTION REQUESTED ON: \_\_\_\_\_ at \_\_\_\_\_ am/pm  
(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the Final Inspection is Requested to Begin. Contractor to be Notified by the Construction Manager in Regards to the Actual Date and Time of the Final Inspection.

\_\_\_\_\_  
PRINT NAME AND TITLE OF PERSON REQUESTING FINAL INSPECTION

\_\_\_\_\_  
SIGNATURE OF PERSON REQUESTING FINAL INSPECTION

Note 2: Contractor Must Accompany Project Inspector, Architect and/or Engineer(s) on Final Inspection, if Requested.

PASSED: \_\_\_\_\_ FAILED: \_\_\_\_\_

Note 3: If the Final Inspection Fails Re-Inspection is Required. See Attached Sheet for Comment(s).

PROJECT INSPECTOR SIGNATURE: \_\_\_\_\_  
DATE: \_\_\_\_\_

PROJECT ARCHITECT SIGNATURE: \_\_\_\_\_  
DATE: \_\_\_\_\_

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CONTRACTOR'S PUNCHLIST INSPECTION REQUEST FORM

PROJECT: \_\_\_\_\_  
DATE RECEIVED: \_\_\_\_\_ (by Inspector)  
TIME RECEIVED: \_\_\_\_\_ (by Inspector)  
  
BUILDING: \_\_\_\_\_  
SITE/OFFSITE: \_\_\_\_\_  
CONSTRUCTION PHASE (1, 2, 3, etc.): \_\_\_\_\_  
SPECIFICATION SECTION (No.): \_\_\_\_\_  
SCOPE OF WORK: \_\_\_\_\_  
(concrete, electrical, etc.)

INSPECTION REQUESTED BY: \_\_\_\_\_  
(contractor company name)

LOCATION(S) OF WORK FOR INSPECTION: (be specific- bldg.(s), room(s), etc.)

DESCRIPTION OF WORK TO BE INSPECTED: (item number(s) from punchlist)

INSPECTION REQUESTED ON: \_\_\_\_\_ at \_\_\_\_\_ am/pm  
(date) (time)

Note 1: A Minimum Notice of 48 hours is Required to be Received by the Inspection Officer Prior to the Time the Punchlist Inspection is Requested to Begin.

\_\_\_\_\_  
PRINT NAME OF PERSON REQUESTING PUNCHLIST INSPECTION

\_\_\_\_\_  
SIGNATURE OF PERSON REQUESTING PUNCHLIST INSPECTION

Note 2: Contractor Must Accompany Project Inspector on Punchlist Inspection, if Requested. Items Must Have Already Been Signed Off by Contractor.

Note 3: Attached Sheet for Contractor's Signoff and/or Inspector's Comments and/or Date Completed for the Specific Punchlist Items Noted Above.

Note 4: This Inspection is NOT A FINAL INSPECTION but Only an Acknowledgement That a Particular Item(s) is/are completed.



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PROJECT: \_\_\_\_\_ - CONTRACTOR'S PUNCHLIST  
CONTRACTOR NAME: \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_

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SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Concealed Work photographs.
  - 3. Periodic construction photographs.
  - 4. Final Completion construction photographs.
  - 5. Preconstruction video recordings.
  - 6. Periodic construction video recordings.
  - 7. Construction webcam.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files monthly, at minimum.
  - 1. Submit photos to District designated Microsoft SharePoint Site. Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image description:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Date photograph was taken.
    - f. Description of location, vantage point, and direction.
    - g. Unique sequential identifier keyed to accompanying key plan.
    - h. Submit videographer/drone operator qualifications including:
      - 1) FCC License.
      - 2) Liability Insurance.

1.4 QUALITY ASSURANCE

- A. If applicable, submit videographer/drone operator qualifications including:
  - 1. FCC License.
  - 2. Liability Insurance.

1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time and GPS location data from camera.
- D. File Names: Name media files with date Project area and sequential numbering suffix.
- E. Periodic Construction Photographs: Take Twenty (20) photographs weekly, and submit monthly, coinciding with the date associated with Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

1.6 CONSTRUCTION WEBCAM

- A. Webcam: Provide one fixed-location camera(s) with weatherproof housing, mounted to provide unobstructed view of construction site from location approved by Architect, with the following characteristics:
  - 1. Static view.
  - 2. Capable of producing minimum 12 megapixel images.
  - 3. Provide pole mount, parapet mount.
- B. Live Streaming Images: Provide web-accessible image of current site image, updated at five-minute intervals when construction is underway.
- C. Web-Based Interface: Provide online interface to allow viewing of each high-definition digital still image captured and stored during construction, from the Internet.
  - 1. Access Control: Provide password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
  - 2. Software: Provide responsive software interface for use on computer, tablet, and mobile screens with accompanying iPhone/iPad app and Android apps.
  - 3. Storage: Maintain images on the website for reference during entire construction period, and for not less than Thirty (30) days after Final Completion. Provide sufficient memory on remote server to store all Project images.
  - 4. Online Interface: Provide website interface with Project and client information and logos, calendar-based navigation interface for selecting images, and pan and zoom capability within high-definition images.
  - 5. Forward and Reverse: Provide capability to browse through images, moving forward and backward in time by individual image and by day.
  - 6. Slideshow: Provide capability to automatically display current images from sites when there are three or more cameras used.
  - 7. Time-Lapse: Provide capability for online display of project time-lapse.
  - 8. Dashboard: Provide capability to view thumbnails of all cameras on one screen.
  - 9. Weather: Provide corresponding weather data for each image captured.

**PHOTOGRAPHIC  
DOCUMENTATION**

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10. Provide public viewer open access.
- D. Maintain cameras and web-based access in good working order, according to web-based construction photographic documentation service provider's written instructions until Final Completion. Provide for service of cameras and related networking devices and software.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 01 33 00 – SUBMITTAL PROCEDURES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely provide all required submittals and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SUBMITTALS

- A. Contractor's responsibilities:
  - 1. The Contractor shall check, verify, and be responsible for all field measurements.
  - 2. The Contractor shall submit a schedule indicating when the required shop drawings and submittals will be submitted to the Architect.
    - a. Submit schedule within the amount of days as indicated in Specification Section - CONSTRUCTION SCHEDULES.
  - 3. Submit copies as scheduled below, checked and approved by the Contractor for all submittals required for the work of the various trades. Deliver submittals promptly to avoid delays in delivery of materials or execution of the work.
    - a. The Contractor (or Subcontractor) shall mark-up the submittals as to project specifics. If the specifications contains a schedule prepared by the Architect (i.e. paint symbols such as DW-1, M-1, CB-1, etc., or tile symbols such as CT-1, CT-2, or IWA, IWB, IWC, etc.), then the submittal will also contain those designations. Submittals without project specifics will be returned to the Contractor as not being properly prepared.
    - b. The Contractor shall stamp the Submittals utilizing any language requested by the Owner in the General Conditions and the following minimum language:

"This submittal has been reviewed by (Name of Contractor) and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. The Contractor has reviewed and approved not only the field dimensions, but the construction criteria, and has also made written notation regarding any information in the Shop Drawings that does not conform to the Contract Documents. The Contractor has reviewed this submittal and coordinated with all other Shop Drawings received to date by the Contractor and this duty of coordination has not been delegated to subcontractors, material suppliers, the Architect, or the design consultants on this project. The Contractor shall also have indicated that it has not relied upon the dimensions shown on the drawings, specifications and schedules, and that the Contractor has double-checked all dimensions for accuracy and fit. (Name of Contractor) also warrants that this submittal complies with the Contract Documents and comprises no variation thereto."

By: \_\_\_\_\_ Contractor's Signature

\_\_\_\_\_  
Contractor's Typed Name

Date: \_\_\_\_\_

- c. Substitutions on shop drawings or in product submittals will not be considered without prior approval in accordance with Specification Section - SUBSTITUTION PROCEDURES. Submittals containing unacceptable items will be rejected.
    - d. The Contractor shall make any corrections required by the Architect during the Architect's initial review, and re-submit the required corrected copies for final review and distribution.
- B. Architect's responsibilities:
  - 1. The Architect will make any desired corrections with reasonable promptness, and return the submittal to the Contractor.
  - 2. The Architect's review of such drawings or schedules shall not relieve the Contractor of responsibility for deviations from the drawings or specifications, unless he has, in writing, called the Architect's attention to such deviations at the time of submission, and secured written acceptance.
    - a. The Architect's review shall be for general conformance with the design concept for the project and general compliance with the information given in the Contract Documents.
    - b. The Architect's review shall not be construed as an "approval," or to relieve the Contractor(s) and material suppliers of responsibility for errors or omissions in the submitted documents.
    - c. Modifications or comments made on the submittals or shop drawings during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications.
    - d. Acceptance of a specific item does not include acceptance of the assembly of which the item is a component.
- C. The following list of items, definitions and required quantities is a minimum required for this project. Verify with FACILITY SERVICES SUBGROUP sections for additional quantities required within those divisions.
  - 1. Product Data: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, other product information, color choices and/or manufacturer's catalog sheets shall be specially prepared for the Project (marked-up with project specifics) and shall be submitted in sequential sets for each category of work:
    - a. Quantity:
      - 1) Unless otherwise indicated in the Contract Documents, provide Six (6) sets.
    - b. Material Safety Data Sheets (MSDS): MSDS are not required, but it is recognized that applicable federal and state laws require the submission of these data sheets to an Owner. MSDS shall be turned over to the Owner (without review by the Architect or it's consultants) in compliance with federal and state laws.
  - 2. Shop Drawings: Newly prepared information, drawn to accurate scale, consisting of drawings, diagrams, schedules, and other data specifically prepared for the Project by the Contractor, a Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Project. Do not reproduce Contract Documents or copy Standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
    - a. Quantity: Provide One (1) reproducible original (vellum, sepia or mylar) and Three (3) opaque (blue-line or black-line xerographic) prints for each sheet or detail.



- 1) The contractor shall receive the marked-up reproducible and copy the required number of sets to the subcontractor, manufacturer's and/or material suppliers.
- b. Contractor's use of Architect's Electronic CAD Files.
  - 1) Upon written request by Contractor, copies of the Architect's electronic CAD files may be available for Contractor's use in connection with this Project.
    - a) Contractor's written request shall be on the Architect's "Contractor's Document Usage Agreement for Requested Documents" and may include an additional Architect's Consultant's Agreements, outlining conditions for providing files.
    - b) Contractor's request shall be limited to drawings directly applicable to the Shop Drawings the Contractor wishes to create for submittal.
    - c) Contractor shall pay the Architect for work incurred for providing the requested files. Payment shall be submitted with the request.
  - 2) The Architect's electronic CAD files are limited to files that already exist and that not all files may be available at the Architect's and Architect's Consultant's discretion.
  - 3) The Architect's electronic CAD files are not part of the Contract Documents and have limitations to the accuracy, incorporating modifications, CAD system formats, CAD entity attributes and layering.
  - 4) The Architect's electronic CAD files have restrictions on Contractor's use, transmittal and delivery of files.
3. Samples: Physical examples specially prepared for the Project (marked-up with project specifics) which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
  - a. Quantity:
    - 1) Unless otherwise indicated in the Contract Documents, provide Four (4) sets.
  - b. Color samples shall be submitted on 8-1/2" x 11" cards for all colors scheduling paint types specified utilizing the paint symbols designated by the Architect in the drawings and specifications.
  - c. Manufactured devices or equipment items:
    - 1) Quantity: One (1) sample, returned to supplier and which, when approved, may be incorporated into the Project.
4. Quality Assurance/Control submittals: Consists of design data, test reports, certificates, manufacturers instructions, and /or manufacturer's field reports.
  - a. Quantity:
    - 1) Unless otherwise indicated in the Contract Documents, provide Six (6) sets.
5. Closeout submittals: Maintenance data, operating manuals, project documents, engineering calculations, and/or warranties shall be submitted when required in the various specification sections:
  - a. Quantity:
    - 1) Unless otherwise indicated in the Contract Documents, provide Two (2) sets.
6. Field Samples: Sample panels of in place construction, or selected area of completed substrates or work showing the anticipated compliance with specified characteristics in order to establish a standard of quality.
  - a. Quantity:
    - 1) See specific specification section requirements.
7. Mockups: Full-sized erected assemblies, used for coordination purposes or for testing in a laboratory, or required for approval in a finish form before the actual Project construction begins.

- a. Quantity:
  - 1) See specific specification section requirements.
- D. Substitution, Dispute or Claim Submittals:
  - 1. Any substitution, dispute or claim submittals relating to this contract, or any Contract breach, which are not disposed of by agreement shall be promptly submitted in accordance with the GENERAL CONDITIONS, as a claim to and decided by the Architect who shall issue a written decision on the dispute.
  - 2. Adequate supporting data shall include, but is not limited; a statement of the reasons for the asserted entitlement, the certified payroll, invoice for material and equipment rental, and an itemized breakdown of any adjustment sought.
  - 3. If no "SUBMISSION UNDER PENALTY OF PERJURY" clause is provided within the GENERAL CONDITIONS, then the Contractor shall certify, at the time of submission of a substitution, dispute or claim, as follows:

*(The rest of this page is left intentionally blank)*

**SUBMITTAL PROCEDURES**  
**SUBMISSION UNDER PENALTY OF PERJURY**

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I \_\_\_\_\_, being the \_\_\_\_\_ (Must be an officer),  
declare under penalty of perjury under the laws of the State of California, and do personally certify and  
attest that: I have thoroughly reviewed the attached substitution, dispute or claim for additional  
compensation and/or extension of time, and know its contents, and said claim is made in good faith; the  
supporting data is truthful and accurate; that the amount required accurately reflects the contract  
adjustment for which the Contractor believes the Owner is liable; and further, that I am familiar with  
California Government Code Section 12650, et seq, pertaining to false claims, and further know and  
understand that submission of certification of a false claim may lead to fines, imprisonment and/or other  
severe legal consequences.

By: \_\_\_\_\_ Contractor's Signature

\_\_\_\_\_ Contractor's Typed Name

Date: \_\_\_\_\_

Submission of a substitution, dispute or claim, properly certified, with all required supporting  
documentation, and written rejection or denial or all or part of the claim by Owner, is a condition  
precedent to any action, proceeding, litigation, suit or demand for arbitration by Contractor.  
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**PART 2 - PRODUCTS**

**NOT APPLICABLE**

**PART 3 - EXECUTION**

**NOT APPLICABLE**

**END OF SECTION**

**SECTION 01 35 16 – ALTERATION PROJECT PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Coordinate the work of trades and schedule elements of alterations and renovation work by procedures and methods to expedite completion of the work.
- C. In addition to demolition specifically shown, cut, move or remove items as necessary to provide access or to allow alterations and new work to proceed. Include such items as:
  - 1. Repair or removal of hazardous or unsanitary conditions.
  - 2. Removal of abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.
  - 3. Removal of unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, and debris such as rotted wood, rusted metals and deteriorated concrete.
  - 4. Cleaning of surfaces, and removal of surface finishes as needed to install new work and finishes.
- D. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a smooth and clean transition to adjacent new items of construction.
- E. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 02 41 19 SELECTIVE DEMOLITION
  - 4. 03 30 00 CAST-IN-PLACE CONCRETE
  - 5. 08 11 00 METAL DOORS AND FRAMES
  - 6. 09 24 00 CEMENT PLASTER
  - 7. 09 29 00 GYPSUM BOARD
  - 8. 09 30 00 TILE
  - 9. 09 91 00 PAINTING
  - 10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 11. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**PART 2 - PRODUCTS**

**2.1 MATERIALS (Products for Patching, Extending and Matching):**

- A. Provide same products or types of construction as that in existing structure as needed to patch, extend or match existing.
- B. The Contract Documents will not typically define products or standards of workmanship present in existing construction; determine products by inspection and necessary testing, and determine quality of workmanship by using existing as a sample for comparison.

- C. The presence of a product, finish, or type of construction requires that patching, extending or matching shall be performed as necessary to make work complete and consistent with identical standards of quality.

### **PART 3 - EXECUTION**

#### **3.1 REPAIR / RESTORATION**

- A. Patch and extend existing construction using skilled workers capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.
- B. Damaged Surfaces:
  - 1. Patch and replace portions of existing finished surfaces that are found to be damaged, lifted, discolored, or show other imperfections, with matching material.
    - a. Provide adequate support of substrate prior to patching the finish.
    - b. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over the entire surface.
    - c. When existing surface finish cannot be matched, refinish entire surface to nearest intersections.
- C. Transition from existing to new work:
  - 1. When new work abuts or finishes flush with existing work, make a smooth and clean transition. Patched work shall match existing adjacent work in texture and appearance so that the patch of transition is invisible at a distance of five feet.
  - 2. When finished surfaces are cut in such a way that a smooth and clean transition with the new work is not possible, notify the Architect. Terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface, or as otherwise directed by the Architect

#### **3.2 ADJUSTING**

- A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Where partitions are removed, patch floors, walls, and ceilings with finish materials to match existing.
  - 1. Where removal of partitions results in adjacent spaces becoming one, re-work floors and ceilings to provide smooth and clean planes without breaks, steps, or bulkheads.
  - 2. Where extreme change of plane of one inch or more occurs, request instruction from the Architect as to method of making transition.
- C. Trim and refinish existing doors as necessary to clear new floor finishes.

#### **3.3 CLEANING**

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  - 1. Leave area level and free of any ruts or debris. Appearance of earth surface shall be equal to or better than adjacent undisturbed surfaces.
  - 2. Clean any soiled surfaces immediately.
  - 3. Finish shall be clean and ready for the application of any additional finishes.

- B. Perform periodic and final cleaning as specified in Specification Section - PROJECT CLOSEOUT.
  - 1. Clean Owner-occupied areas daily.
  - 2. Clean spillage, over spray, and heavy collection of dust in Owner-occupied areas immediately.
- C. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
- D. At completion of alteration work in each area, provide final cleaning and return space to a condition suitable for use by the Owner.
- E. Contractor shall remove all materials and items as indicated on drawings or otherwise required. Remove all trash or debris as it accumulates and legally dispose of it off site at no additional cost to the Owner.

### 3.4 PROTECTION

- A. Protection from weather:
  - 1. Protect newly installed work from freezing for 24 hours after erection, installation or application.
- B. Protection from traffic:
  - 1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.
  - 2. Immediately after cleaning, neatly apply four (4) mil thick, minimum, polyethylene film over finished surfaces at traffic areas. Fasten film firmly to surfaces without visually marring those surfaces.
- C. Assign the work of moving, removal, cutting and patching, to trades qualified to perform the work in a manner to minimize the possibility of damage to each type of work, and provide means of returning surfaces to appearance of new work.
- D. Perform cutting and removal work with minimal disruption and manner to avoid damage to adjacent work.
- E. Cut finish surfaces such as masonry, tile, plaster or metals, by methods which terminate surfaces in a straight line at a natural point of division.
- F. Perform cutting and patching as specified in Specification Section - CUTTING AND PATCHING.
- G. Protect existing finishes, equipment, and adjacent construction from damage.
  - 1. Protect existing and new work from weather and extremes of temperature.
  - 2. Maintain existing interior work above 60 degrees F.
  - 3. Provide weather protection, waterproofing, heat and humidity control as needed to prevent damage to remaining work and to new work.

### 3.5 SCHEDULES

- A. Schedule work in the sequences specified in Specification Section - SUMMARY OF WORK, if applicable.

END OF SECTION

**01 35 43 SPECIAL PROJECT PROCEDURES****PART 1 GENERAL****1.1 SUMMARY**

- A. The requirements for the following subjects are included in this Section:
  - 1. Environmental Protection Plan.
  - 2. Noise Control.
  - 3. Dust and Air Pollution Control.
  - 4. Erosion and Sediment Control.
  - 5. Disposal Operations.
  - 6. Cultural Resources.
  - 7. Endangered Species.

**1.2 RELATED SPECIFICATION SECTIONS**

- A. DIVISION 00 SPECIFICATION SECTIONS.
- B. DIVISION 01 SPECIFICATION SECTIONS.
- C. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
- D. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
- E. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.3 ENVIRONMENTAL PROTECTION PLAN**

- A. Comply with the Requirements of the STORMWATER POLLUTION PREVENTION PLAN (SWPPP).

**1.4 NOISE CONTROL**

- A. Comply with Specification Section, TEMPORARY FACILITIES AND CONTROLS

**1.5 DUST AND AIR POLLUTION CONTROL**

- A. Comply with Specification FUGITIVE DUST CONTROL

**1.7 EROSION AND SEDIMENT CONTROL**

- A. Comply with the Requirements of the STORMWATER POLLUTION PREVENTION PLAN (SWPPP).

**1.8 DISPOSAL OPERATIONS**

- A. Comply with Specification Section, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

**1.9 CULTURAL RESOURCES**

- A. The Contractor is advised of the possibility that cultural resources may be discovered during project activities.
- B. Prior to the start of construction, employees and subcontractors and any other persons working on the site for the project shall be informed in writing of the potential for the discovery of important paleontological resources below the ground surface on the project site. If any such resources are found, all work shall halt within the area in question. Notify the Owner and a qualified paleontological resources specialist who in turn will evaluate the find and make recommendations for further action.



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- C. Prior to the start of construction, employees and subcontractors and any other persons working on the site for the project shall be informed in writing of the potential for the discovery of important cultural resources below the ground surface on the project site and the legal consequences for damaging or destroying such resources. If any such resources are found, all work shall halt within the area in question. Notify the Owner and a qualified paleontological resources specialist who in turn will evaluate the find and make recommendations for further action.
- D. If human remains are discovered during the project activities, the Fresno County Coroner must be notified immediately. The coroner has two working days to examine the remains and 24 hours to recommend proper treatment or disposition of the remains, following the Native American Heritage Commission guidelines.

**1.10 ENDANGERED SPECIES**

- A. Prior to start of construction, the Owner's agent will conduct a Survey for Active Raptor nests. It is anticipated that the Survey will occur during the non-breeding season (August through January). If relocation is required, this will be done prior to the start of construction.

**1.11 TRAFFIC CONTROL PLAN**

- A. Comply with Specification Section, TEMPORARY FACILITIES AND CONTROLS

**END OF SECTION**

SECTION 01 41 00 – REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
  - 2. Section 4-317 (c), Part 1, Title 24, CCR, requires the following:
    - a. "The intent of these drawings and specifications is that the work of the alteration, rehabilitation or reconstruction is to be in accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration of non-complying construction be discovered which is not covered by DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work."
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 REFERENCES

- C. References to standards, codes, specifications, recommendations and regulations, refer to the latest edition or printing in effect at the date of issue shown in the Documents unless another date is implied by the suffix number of the Standards.
- D. Applicable portions of the Standards listed that are not in conflict with the Contract Documents shall be construed as specification for this work.
- E. General Standards:
  - 1. AFPA American Forest and Paper Association
  - 2. ANSI American National Standards Institute
  - 3. ASTM American Society for Testing and Materials
  - 4. CAL/OSHA California Occupational Safety and Health Administration
    - a. State of California Construction Safety Orders
  - 5. CARB California Air Resources Board
  - 6. CS Commercial Standards of the US Department of Commerce
  - 7. EPA Environmental Protection Agency
  - 8. FMG Factory Mutual Group
  - 9. NIBS National Institute of Building Sciences
  - 10. NIST National Institute of Standards and Technology
  - 11. NFPA National Fire Protection Association
  - 12. OSHA Occupational Safety and Health Administration
    - a. Federal Construction Safety Orders

- 13. PS Product Standards of the US Department of Commerce
- 14. SS-CDOT "Standard Specification":
  - a. State of California Department of Transportation (CalTrans)
- 15. UL Underwriters Laboratory Incorporated
- 16. WH Warnock Hersey

1.3 SUBMITTALS

- 17. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- 18. Quality Assurance/Control Submittals:
  - a. Certificates:
    - 1) Submit three (3) copies of certificates written on the Contractor's Letterhead indicating that the required codes shall be present at the Job Site.

1.4 QUALITY ASSURANCE

F. Regulatory Requirements:

- 1. All codes, laws, ordinances, rules, regulations, orders and other legal requirements of City, County, State, Federal and other public authorities which bear on performances of Work shall be applicable to Project. Latest editions shall be applicable unless specified otherwise.
- 2. Relationship between Applicable Codes and Contract Documents. The Contract Documents have been developed with the intent to conform to the applicable codes. Nothing within the Contract Documents shall be construed to permit Work not conforming to the applicable codes.

G. Major Governing Codes And Regulations:

- 1. General: All work shall comply with the requirements of the following codes and regulations. Special reference in other Sections of the Specifications to a specific code will be by use of the abbreviation given in front of the Code.
  - a. Freestanding equipment (if applicable) shall be provided and installed in accordance with the seismic requirements where the Project is located.
- 2. NOTE: \* -Indicates that a copy of these codes shall be at the job site at all times.
- 3. AUTHORITY HAVING JURISDICTION:
  - a. AHJ: Authority Having Jurisdiction
- 4. FEDERAL LAW:
  - a. ADA: Americans with Disabilities Act
- 5. CALIFORNIA CODE OF REGULATIONS (Previously known as the California Administrative Codes)
  - a. CCR-T5: California Code of Regulations, Title 5-Education.
  - b. CCR-T8: California Code of Regulations, Title 8-Industrial Safety
    - 1) Contains the California Elevator Safety Code.
  - c. CCR-T19: California Code of Regulations, Title 19-Public Safety.
  - d. CCR-T21: California Code of Regulations, Title 21-Public Works.
  - e. \*CCR-T24: California Code of Regulations, Title 24, Part 1-California Administrative Code 2022.
- 6. CALIFORNIA BUILDING, ELECTRICAL, MECHANICAL, PLUMBING, ENERGY, FIRE, and REFERENCED CODES

- a. \*CBC: California Building Code 2022 California Code of Regulations, Title 24-Part 2, Volumes 1 and 2, CCR-T24, based on the 2021 edition of the IBC (International Building Code), with the latest California State Amendments.
  - b. \*CEC: California Electrical Code 2022, California Code of Regulations, Title 24-Part 3, CCR-T24, based on the 2020 edition of the NEC (National Electrical Code), with the latest California State Amendments.
  - c. \*CMC: California Mechanical Code 2022, California Code of Regulations, Title 24, Part 4, CCR-T24, based on the 2021 edition of the UMC (Uniform Mechanical Code) by IAPMO, with the latest California State Amendments.
  - d. \*CPC: California Plumbing Code 2022, California Code of Regulations, Title 24, Part 5, CCR-T24, based on the 2021 edition of the UPC (Uniform Plumbing Code) by IAPMO, with the latest California State Amendments.
  - e. \*CEnC: California Energy Code 2022, California Code of Regulations, Title 24, Part 6, CCR-T24, and the latest California State Amendments.
  - f. \*CFC: California Fire Code 2022, California Code of Regulations, Title 24, Part 9, CCR-T24, based on the 2021 edition of the IFC (International Fire Code), with the latest California State Amendments.
    - 1) In addition to all other Chapters in the CFC to be followed, attention is specifically called out to comply with Chapter 33 - "Fire Safety During Construction and Demolition".
  - g. CEBC: California Existing Building Code 2022, California Code of Regulations, Title 24, Part 10, CCR-T24.
  - h. CGBSC: California Green Building Standards Code 2022, California Code of Regulations, Title 24-Part 11, CCR-T24 (CALGreen).
  - i. CRSC: California Referenced Standard Code 2022, Title 24, Part 12, CCR-T24, with the latest California State Amendments.
  - 7. DSA: DIVISION OF THE STATE ARCHITECT:
    - a. DSA: Regulations of the Division of the State Architect of the State of California:
      - 1) ACS: Access Compliance Section
      - 2) SSS: Structural Safety Section
      - 3) FLS: Fire and Life Safety Section
      - 4) IR: Interpretation of Regulations.
  - 8. OTHER STATE AGENCIES:
    - a. AQMCD: Air Quality Management Control District in the area where the project is located.
    - b. RWQCB: Regional Water Quality Control Board in the area where the project is located.
- H. Governing Authority:
- 1. DSA: Division of the State Architect.
    - a. The provisions of the State of California, Statutes of 1933, Chapter 59, Safety of Construction of Public School Buildings Act, and the latest regulation based thereon, of the Division of the State Architect of the State of California, shall be the governing authority and shall take precedence over other applicable codes.
    - b. The following shall be stamped and signed by the A/E on Record or Delegated Design Professional per CBC, Part 1, Section 4-317 (h), and the following:
      - 1) Addenda or Bulletins per Sec. 4-338(b): All addenda or bulletins shall be signed and approved by the Division of State Architect.

**REGULATORY  
REQUIREMENTS**

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- 2) Construction Changes per Sec. 4-338(c): All Construction Changes related to structural items, fire safety issues, life safety issues and accessibility compliance issues shall be reviewed and approved by the appropriate Division of the State Architect.
- 3) Substitutions (per DSA) shall be treated like Addenda, or Construction Changes per Sec. 4-338(c), and IR A-6: All substitution requests and substitutions related to structural items, fire safety issues, life safety issues and accessibility compliance issues shall be reviewed and approved by the appropriate Division of the State Architect prior to fabrication and installation.

**PART 2 - PRODUCTS**

NOT APPLICABLE

**PART 3 - EXECUTION**

NOT APPLICABLE

**END OF SECTION**

## SECTION 01 42 00 – REFERENCES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    - a. The abbreviations, symbols and work meanings not defined in the Contract Documents are in accordance with building industry usage and convention. Questions which arise as to "meaning," or intent shall be referred to the Architect prior to bidding for interpretation.
    - b. Refer to drawings for additional abbreviations and symbols.
    - c. Refer to GENERAL and SPECIAL or SUPPLEMENTAL CONDITIONS and specific specification Sections for additional definitions.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- A. EXECUTE Perform what is required to install, apply, erect and otherwise incorporate products in to this Project.
- B. FURNISH Supply products required, deliver to Project, unload, store and install as required in location as directed by Contractor, Owner or Architect.
- C. GUARANTEE An assurance by the seller or installer that products or Work are as represented or will be as promised in compliance with Specifications. Synonymous and interchangeable with WARRANTY.
- D. INSTALL Incorporate into this Project.
- E. PRODUCTS The material, equipment, fixtures and other physical substances required to execute the Project.
- F. PROVIDE Furnish and Install into this Project.
- G. WARRANTY An assurance by the seller or installer that products or Work are as represented or will be as promised in compliance with Specifications. Synonymous and interchangeable with GUARANTEE.

## PART 2 - PRODUCTS

NOT APPLICABLE

## PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION

**SECTION 01 45 23 – TESTING AND INSPECTION SERVICES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. This Section includes the following:**

1. One Project Inspector (Owner's Inspector), including Special and/or Assistant Inspector(s) (minimum Class 1 Rating), as required, will be employed by the Owner in accordance with the requirements of CCR-Title 24, Part 1, CALIFORNIA ADMINISTRATIVE CODE, and the latest amendments, and will be assigned to the Project.
    - a. Duties of a Project Inspector are specifically defined in CCR-Title 24, Part 1, and the latest amendments.
    - b. Special Inspections (not within the Project Inspector's abilities) shall be performed by the Testing Laboratory or other Special Inspector as approved by the Owner and DSA.
      - 1) All Special Inspections shall be approved by DSA in accordance with CCR-T24, Part 1, Chapter 4, Group 1, Article 5, Section 4-335.1.
  2. The Project Inspector shall be employed by the Owner and approved by the Architect, Structural Engineer, and DSA.
    - a. See the Title Page of this Project Manual for the name of this Project.
    - b. Payment of the Project Inspector will be by the Owner.
  3. Provide all access, facilities and information required by the Project Inspector for the Project.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:**
1. DIVISION 00 SPECIFICATION SECTIONS.
  2. DIVISION 01 SPECIFICATION SECTIONS.
  3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.2 DEFINITIONS**

**A. Responsibilities of the Project Inspector:**

1. The Project Inspector will be required to provide inspection of the Work (including "Continuous Inspection") as required in CCR-T24, Part 1:
  - a. Educational Work: Chapter 4, Group 1, Article 6, 4-342 (b).
2. The Project Inspector will report to the Owner, the Architect and DSA as required during the progress of the Work.
3. The Project Inspector shall review all Pay Requests prior to submittal to the Architect.

**B. Responsibilities of the Contractor:**

1. Written Statement of Responsibility to the Owner and the Authority Having Jurisdiction (DSA) per CBC Chapter 17A:

- a. Provide a written Statement of Responsibility regarding the Contractor's understanding of the special inspection requirements and identifying individuals in their firm responsible for exercising control over the conformance to the construction documents.
2. Provide the Project Inspector free access to any and all parts of the Project at all times.
3. Provide the Project Inspector information necessary to keep him fully informed with respect to the progress, manner and character of Work.
4. Perform no Work in absence of the Project Inspector unless alternate arrangements have been made in advance and agreed to by the Owner, the Architect and DSA.
5. The Owner's "Inspection of Work" by the Project Inspector shall not relieve the Contractor from any conditions of this Contract.

### 1.3 SUBMITTALS

#### A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Quality Assurance/Control Submittals:
  - a. Written Statement of Responsibility to the Owner and the Authority Having Jurisdiction per CBC Chapter 17A.
  - b. Project Inspector's Field Reports:
    - 1) Submit four (4) copies of reports.

### 1.4 QUALITY ASSURANCE

#### A. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

### PART 2 - PRODUCTS

NOT APPLICABLE

### PART 3 - EXECUTION

NOT APPLICABLE

END OF SECTION



SECTION 01 45 29 – TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. The Owner's Testing Laboratory shall be employed by the Owner and approved by the Architect, Structural Engineer, and DSA.
    - a. Payment of the Owner's Testing Laboratory will be by the Owner.
    - b. The Owner shall pay for all initial testing indicated as paid for by Owner except as specified otherwise or in the schedule at the end of this section.
      - 1) Cost of re-testing (due to initial failures) shall be back-charged to the Contractor, and those excess costs will be deducted from the Contract Price.
      - 2) Cost of testing (due to shop fabrication or in-plant testing out of state and beyond a 75 mile radius of the Project Site) shall be back-charged to the Contractor, and those excess costs will be deducted from the Contract Price.
  - 2. Provide all access, facilities and information required for the testing of the various portions of the Work as required by Regulatory Agencies, Planning, Agencies, Building Agencies, and other Governmental Inspectors, the Contract Documents and the Owner.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 DEFINITIONS

- A. Responsibility of the Testing Laboratory:
  - 1. Taking all specimens.
  - 2. Performing Tests.
    - a. The Testing Laboratory's duties shall include all tests required by these drawings and specifications, as summarized on the DSA 103 Form prepared at the time of DSA Approvals, and any other testing as determined by authorities or the Project Inspector during the course of the work.
    - b. Special Inspections (not within the Project Inspector's abilities) shall be performed by the Testing Laboratory or other Special Inspector as approved by the Owner and DSA.
      - 1) All Special Inspections shall be approved by DSA in accordance with CCR-T24, Part 1, Chapter 4, Group 1, Article 5, Section 4-335.
  - 3. Writing Test Reports
  - 4. Review of "Continuous Inspection" reports by the Project Inspector.
    - a. Portions of the Work requiring "Continuous Inspection" shall be performed by the Project Inspector (if qualified) and all reports will be reviewed by the Testing Laboratory.
  - 5. Distribute Test Reports to the Owner, Architect, applicable Engineer, Contractor and to DSA.

**B. Responsibilities of the Contractor:**

1. Contractor shall provide a Testing Schedule that is in accordance with the following:
  - a. Format of the Testing Schedule shall be in accordance with Specification Section – CONSTRUCTION SCHEDULES.
  - b. Cooperates with the Testing Laboratory's schedule of required testing.
  - c. Contractor shall coordinate Construction Schedule and Testing Schedule.
    - 1) Format of testing schedule in accordance with Specification Section – CONSTRUCTION SCHEDULES.
2. Cooperation with testing laboratory:
  - a. Provide access to Work being tested.
  - b. Provide test samples as selected by testing laboratory.
  - c. Schedule Work so that there shall be no excessive inspection time.
    - 1) At times that an inspector is required, sufficient work shall be laid out and adequate personnel supplied so that the inspector's time shall be used to full advantage.
    - 2) If inspection costs become excessive because of poor shop or construction procedure, such excess costs will be paid for by the Owner, but deducted from the Contract Price.
  - d. Inspections and tests required by regulatory agencies shall be the responsibility of and shall be paid for by the Owner unless specified otherwise.
  - e. Inspections and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.
  - f. Test Reports:
    - 1) Distribute test reports and related instruction to insure all required re-testing and/or replacement of materials.
  - g. Payment of Testing:
    - 1) All testing shall be paid for by the Owner.
3. Contractor shall be backcharged for re-testing, excessive distance from the Project Site, or extra testing required because of initial failures.

**1.3 SUBMITTALS**

**A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:**

1. Quality Assurance/Control Submittals:
  - a. Test Reports:
    - 1) Submit four (4) copies of testing laboratory's report.

**1.4 QUALITY ASSURANCE**

**A. Qualifications:**

1. Testing Laboratory Qualifications:
  - a. In accordance with the latest Edition of ASTM E-329.

**B. Regulatory Requirements and Reference Standards:**

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. In accordance with regulatory agencies and appropriate ASTM Standards.

PART 2 - PRODUCTS  
NOT APPLICABLE

PART 3 - EXECUTION  
NOT APPLICABLE

3.1

END OF SECTION

**SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Temporary Utilities, Support Facilities, and Protection Facilities materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.2 SUBMITTALS**

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Shop Drawings:
    - a. Project Sign.
  - 2. Quality Assurance/Control Submittal:
    - a. Copy of Application to APCD for Dust Prevention and Control Plan.
    - b. Copy of approved Application to APCD for Dust Prevention and Control Plan.
    - c. Copy of Application to local City or County Engineer for Traffic Control.
    - d. Copy of approved Application to local City or County Engineer for Traffic Control.
    - e. Temporary Project Enclosure Plan.

**1.3 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CARB      Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
    - b. CAL/OSHA      California Division of Occupational Safety and Health Administration
    - c. EPA      Environmental Protection Agency
- B. Dust Prevention and Control Plan:
  - 1. Prior to commencing the Work, prepare a Dust Prevention and Control Plan and obtain review and approval of the Air Pollution Control District (APCD) in the area where the project is located.

- a. Prepare application and file with appropriate fees to APCD upon completion of Dust Prevention and Control Plan.
  2. The Dust Prevention and Control Plan shall specify the methods of control that will be utilized, demonstrate the availability of needed equipment and personnel, and identify a responsible individual who, if needed, can authorize implementation of additional measures.
  3. All construction shall comply with applicable elements of the APCD's regulations.
  4. The Dust Prevention and Control Plan shall include, but not be limited to, the following:
    - a. Contractor's name and project identification information.
    - b. Procedures and measures to be implemented, but not be limited to:
      - 1) All material excavated or graded shall be sufficiently watered to prevent excessive amounts of dust.
      - 2) During periods of high winds, all clearing, grading, earth moving, or excavation shall cease when dust control measures are unable to avoid visible plumes.
      - 3) All dust producing material transported off site shall be either sufficiently watered or securely covered to prevent excessive amounts of dust.
      - 4) The area disturbed by clearing, earth moving, or excavation activities shall be minimized at all times.
      - 5) All watering of areas shall be only to the extent required to keep the soil particles in a moist condition and not to the extent that erosion of surface soil occurs.
      - 6) To control general fugitive dust, on-site vehicle speed shall be limited to 15 mph.
      - 7) All areas with vehicle traffic shall be watered periodically for stabilization of dust emissions.
      - 8) Periodically streets adjacent to the project site shall be cleaned as required to remove silts which may have accumulated from construction activities.
- C. Traffic Control Plan:
1. Prior to commencing the Work, prepare a Traffic Control Plan and obtain approval of the local City or County Engineer in the area where the project is located.
    - a. Prepare application and file with appropriate fees to the local City or County Engineer upon completion of Traffic Control Plan.
  2. The Traffic Control Plan shall include information on construction timing and phasing and proposed methods of alleviating potential hazardous and/or inconvenient conditions. Such methods can include, but are not limited to, the use of flagmen, barricades, signs, warning lights, detours, phased lane closures, coordination with adjacent property owners, and coordination with law enforcement, fire protection and other emergency service agencies.
- D. Temporary Project Enclosure Plan:
1. Prior to commencing the Work, prepare a Temporary Project Enclosure Plan indicating the protection of people, animals, and partial and fully completed work until occupancy by the Owner.
  2. Identify temporary egress from existing occupied facilities and as required by authorities having jurisdiction.
  3. The Temporary Project Enclosure Plan shall include, but not be limited to, the following:
    - a. Contractor's name and project identification information.

- b. Indicate the duration of the proposed measures based on the completion of the work as a whole and if any phases of work are identified.
  - c. Indicate proposed temporary fencing and potential exit and entry paths.
    - 1) Show gate and door locations and indicate who has access.
  - d. Indicate proposed temporary wall location(s) and potential exit and entry paths.
    - 1) Show door location(s) and indicate who has access.
  - e. Indicate type of material used for temporary fencing, walls, gates, and doors.
  - f. Indicate proposed temporary roads and paved areas.
  - g. Indicate proposed temporary offices and storage areas.
- E. Copy of approved Fire Protection Program:
- 1. Contractor shall be responsible for the development, implementation, and maintenance of a written plan establishing a fire prevention program at the project site applicable throughout all phases of the construction, repair, alteration, or demolition work in accordance with CFC Chapter 33, Section 3308 and sub-sections.
  - 2. It is the Contractor's responsibility to contact local Fire Authority to discuss the plan.
    - a. A copy of the report should be made available to the Project Inspector and local Fire Authority.
  - 3. Approval Required: Prior to commencing the Work, prepare a Fire Protection Program and obtain review and approval from the local Fire Authority in the area where the project is located.
  - 4. Plan shall address at a minimum:
    - a. Each phase of the construction, repair, alteration, or demolition work.
    - b. Designate responsible program superintendent in accordance with CFC 3308.2.
    - c. Duties of staff.
    - d. Staff training requirements.
    - e. Prefire plans.
    - f. Fire protection devices.
    - g. Hot work operations.
    - h. Impairment of fire protection systems.
    - i. Temporary covering of fire protection devices.

#### 1.4 PROJECT CONDITIONS

- A. Environmental Requirements:
- 1. Heating and Cooling:
    - a. Provide temporary heating and cooling required by construction activities for curing, acclimating the building or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed, and is maintained prior, during and after the installation in accordance with the exterior or interior building materials temperature and humidity guidelines.
      - 1) Do not use heating units that contribute moisture to the enclosed spaces under construction.
  - 2. Ventilation and Humidity Control:

- a. Provide temporary ventilation required by construction activities for curing, acclimating the building or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  - 1) Exterior Moisture Control:
    - a) Perform the installation of all exterior building cladding only after the substrate to which they are being applied is dry and ready to receive them. Do not apply any cladding if it will trap moisture inside a wall or roof cavity (i.e. insulation that has become wet for whatever reasons).
  - 2) Interior Moisture Control:
    - a) Perform the installation of all interior moisture sensitive building materials only after the building or space is acclimated to the final environmental conditions under which the building is to be operated in accordance within the Owner's humidity control guidelines.
- b. Maintain a consistent humidity in accordance with the guidelines for those materials in the space at least seven (7) days prior to installation of any moisture sensitive materials (i.e. Veneer Plaster, Gypsum Board, Ceiling Tiles, Wood Sensitive Floors, other Flooring sensitive to moisture levels, Interior Painting, etc.).
- c. Maintain the same levels of temperature and humidity during the installation of those materials, and after the installation of those materials until the building's own mechanical systems can be turned on to maintain the facility within the Owner's temperature and humidity control guidelines.
- d. Replace any materials that have become wet and damaged due to the Contractor not properly protecting installed building materials at no additional cost to the Owner.
- 3. Dust control:
  - a. Perform work in a manner as to minimize the spread of dust and flying particles.
  - b. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
- 4. Burning: No burning will be allowed on-site.
- 5. Noise Control:
  - a. Stationary noise sources shall be of a low-noise emission design, consistent with the best available noise reduction technology.
  - b. The hours of operation of noise-generating equipment shall be restricted to 6:00 a.m. to 7:00 p.m. Monday through Friday, and to 8:00 a.m. to 6:00 p.m. on Saturday and Sunday.
  - c. Mufflers shall be required on all gas and diesel-powered equipment.
- B. Existing Conditions:
  - 1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT**

**A. Fire Protection During Construction:**

1. Provide Temporary Fire Protection per CFC Chapter 33 during demolition and construction.

**B. Field Offices:**

1. General Note: Provide one (1) 2A:10B:C Wall Surface Mounted Fire Extinguisher in each field office as a minimum per the CSFM.

2. Contractor's Field Office:

- a. Size: Nominal 8 feet wide minimum, approximately 96 square feet minimum.

- b. Equipment:

- 1) Table for review of Drawings.
    - 2) Files, rack and shelves as required to store Contract Drawings and Project Record Drawings in a neat, orderly manner.
    - 3) One copy of each code listed in Specification Section - REGULATORY REQUIREMENTS.
    - 4) Telephone.
    - 5) Internet Connection.
    - 6) Plain Paper Copier / FAX Machine.

- c. Facilities:

- 1) Adequate light and power.
    - 2) Adequate heating, ventilation and air conditioning.

- d. Control and Access:

- 1) Door shall be lockable and key shall be supplied to Architect and access shall be limited to Owner, Architect, Inspector and Contractor.

- e. All of the above items shall be subject to Architect's approval.

3. Project Inspector's Field Office:

- a. Size: Nominal 8 feet wide minimum, approximately 96 square feet minimum.

- b. Equipment:

- 1) Table for review of Drawings.
    - 2) Files, rack and shelves as required to store Contract Drawings and Project Record Drawings in a neat, orderly manner.
    - 3) Space for one copy of each code listed in Specification Section - REGULATORY REQUIREMENTS.
    - 4) Telephone.
    - 5) Internet Connection.
    - 6) Plain Paper Copier / FAX Machine.

- c. Facilities:

- 1) Adequate light and power.
    - 2) Adequate heating, ventilation and air conditioning.

- d. Control and Access:

- 1) Door shall be lockable and key shall be supplied to Architect and access shall be limited to Owner, Architect, Inspector and Contractor.

- e. All of the above items shall be subject to Architect's approval.



**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Site verification of conditions:
  - 1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 2. Execution of work under this specification section shall constitute acceptance of existing conditions.
  - 3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the work under this section.

**3.2 PREPARATION**

- A. Coordination:
  - 1. Before proceeding, verify plans match existing conditions.
  - 2. Coordinate work under this specification with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  - 1. The Contractor shall verify and protect existing landscaping, asphalt area, concrete walkways, and other site improvements to remain on the site before proceeding with the Work.
  - 2. Prior to starting Work, hose bibbs, utility lines, etc., to be abandoned and removed within the construction area shall be stubbed off outside the limits of construction.
  - 3. Verify and protect utilities to remain within the construction area and provide special construction for their protection.

**3.3 IMPLEMENTATION**

- A. General:
  - 1. Perform Work and provide and maintain Temporary Utilities and Temporary Facilities in accordance with the requirements of all regulatory authorities having jurisdiction.
  - 2. Contractors shall cooperate with other contractors and the Owner in the use of the site, Temporary Utilities, Temporary Facilities and shall adjust their operations to maintain harmonious relations and uninterrupted progress of the Work.
  - 3. The Contractor shall assume all responsibility for the provision and maintenance of these Temporary Utilities and Temporary Facilities and for the provisions of public safety where the operations under this Contract interface with public areas.
  - 4. Relocate and modify Temporary Utilities and Temporary Facilities, as required by progress of the Work.
  - 5. Remove Temporary Utilities and Temporary Facilities upon completion of the Project.
  - 6. Temporary Utilities and Temporary Facilities are to be provided and maintained from commencement of Work until final acceptance.
    - a. The Contractor shall pay all charges required of him for the duration of the project, including a 1 month period following the date of the Notice of Substantial Completion.

**B. Temporary Utilities:**

1. Install temporary service or connect to existing service.
  - a. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
    - 1) Minimum forty-eight (48) hours prior notice to any interruption.
2. Sewers:
  - a. Provide temporary service to remove effluent lawfully.
3. Storm Drainage:
  - a. Provide temporary service as necessary to remove storm water. Work shall be performed in accordance with the requirements of the Storm Water Pollution Prevention Plan (SWPPP), if any. If no SWPPP is required, then follow local authorities having jurisdiction requirements.
4. Water:
  - a. The Contractor will arrange and pay for all water supply for all purposes of construction at a location to be designated at the site. Extensions within the site shall be provided by the Contractor and maintained in a safe and efficient manner.
  - b. The Owner will pay for all water supply for all purposes of construction at a location to be designated at the site. Extensions within the site shall be provided by the Contractor and maintained in a safe and efficient manner.
5. Electrical:
  - a. The Owner will pay and the Contractor shall provide for all electrical facilities and services for all purposes of power and lighting for construction at a location to be designated at the site. Extensions within the site shall be provided by the Contractor and maintained in a safe and efficient manner.
    - 1) The Contractor shall pay for cost of electrical energy required in connection with the testing of such equipment as generators, transformers, power machinery, and similar equipment installed in the work.
  - b. The Contractor will provide electrical energy to all subcontractors as required on or about the premises.
  - c. The Contractor will provide power outlets having adequate electrical characteristics and lighting of adequate intensity for the use of other contractors within reasonable distances from their needs and within a reasonable period of time after the other contractors have requested them.
6. Telephone:
  - a. The Contractor shall provide and pay for all telephone service and telephone equipment in the Field Offices until completion of the Work.
    - 1) Provide an additional dedicated phone line for modem/network connection in the Project Inspector's Field Office for use by the Architect's representative.
7. Heating:
  - a. Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity.
  - b. Select UL or FM approved equipment that will not have a harmful effect on completed installations or elements being installed.

- 1) Except where use of the permanent heating system is authorized, provide temporary units that do not introduce moisture into the newly constructed building spaces.
  - 2) Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
  - c. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- C. Temporary Facilities:
1. Support Facilities:
    - a. Offices and Storage:
      - 1) Provide temporary offices and storage facilities located within the construction area.
      - 2) Protect materials, construction work and their operations from weather, vandalism, and theft.
    - b. Sanitary Facilities:
      - 1) Provide adequate, self-contained toilets as required for all persons employed on the Project.
      - 2) In no case shall the permanent plumbing fixtures of the Project be used for this purpose.
    - c. Temporary Roads and Paved Areas:
      - 1) Construct and maintain temporary roads and paved areas adequate for construction operations and fire protection during construction.
    - d. Traffic Controls:
      - 1) Implement procedures and measures outlined in the local jurisdiction's approved Traffic Control Plan.
      - 2) Maintain access for fire-fighting equipment and access to fire hydrants.
      - 3) Conduct work and comply with applicable building codes and regulations regarding the use of public streets and sidewalks and the proper barricading and lighting of public thoroughfares surrounding the construction activities.
      - 4) Provide and maintain access as required to perform work.
      - 5) Repair all damage as a result of work performed on the project to adjacent roads, streets, drives and walks. Restore to condition as good as existed at commencement of the Work.
  2. Protection Facilities:
    - a. Existing Facilities:
      - 1) Protect existing vegetation, equipment, structures, utilities, and other improvements at project site and on adjacent properties, except those indicated to be removed or altered. Damage occurring during the course of construction shall be repaired to condition at the start of the Work.
    - b. Environmental:
      - 1) Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
    - c. Project Enclosure:

- 1) Implement procedures and measures outlined in Temporary Project Enclosure Plan.
- 2) Project enclosure shall protect materials, construction work, and operations from vandalism, theft, and to exclude the intrusion of the public into the construction area.
- 3) Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by the Owner from fumes and noise.
- 4) Maintain security by limiting number of keys and restricting distribution to authorized personnel.

**3.4 CLEANING**

**A. Clean in accordance with Specification Section – PROJECT CLOSEOUT.**

1. At all times, keep the premises free from accumulations of waste materials or rubbish caused by employees or the Work.
2. Clean all soiled surfaces to remain immediately.
3. At the completion of the Work, remove all rubbish from and about the building and all tools, scaffolding, and surplus materials and shall leave the Work "broom clean" or its equivalent.

**END OF SECTION**

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

### SECTION 01 57 23 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

#### PART 1 - GENERAL

##### 1.1 SUMMARY

A. This Section includes the following:

1. Provide all material, labor, and services necessary to: comply with the State of California Construction General Permit Order 2022-0057-DWQ (CGP); implement the Project Storm Water Pollution Prevention Plan (SWPPP); and install and maintain appropriate Best Management Practices (BMP) according to the SWPPP and California Stormwater Quality Association (CASQA) Construction BMP Handbook.
2. Retain a certified Qualified SWPPP Practitioner (QSP) to implement all Construction Site Monitoring Program (CSMP) elements of the SWPPP, or delegate appropriate roles to the trained Contractor.
3. Complete and maintain all inspections, sampling, weather monitoring, and recordkeeping required by the CGP, commensurate with a Risk Level 1 SWPPP.
4. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants within 90-days of completing outdoor construction activities; and notifying Owner and QSD of acceptable termination conditions.
5. All Contract requirements in Division 00 and 01 specifications.

B. This Section does not include:

1. The Owner shall retain a Qualified SWPPP Developer (QSD) to prepare the SWPPP document.
2. The Owner shall submit the Notice of Intent (NOI), SWPPP, Changes of Information (COI), and Annual Reports, Notice of Termination (NOT) to the SWRCB on SMARTS.
3. The Owner shall complete all required QSD inspections.
4. The Owner shall pay the NOI application fee and annual renewal fees.
5. The Owner shall maintain the role of LRP and all responsibilities associated, except where those responsibilities are assigned to the Contractor within these specifications.
6. The Owner shall complete online digital certification of online reporting on SMARTS
7. After the Contractor has met all conditions for SWPPP termination, Owner shall complete the NOT and obtain approval from SWRCB. If the NOT is returned by SWRCB due to unacceptable site conditions, Contractor shall implement any redresses specified by the SWRCB.
8. Owner shall ensure that the Project design has incorporated all post-construction requirements specified by the CGP, MS4 permittee, and local agency stormwater regulations.

C. Acronyms:

- |          |   |
|----------|---|
| 1. BMP   | Best Management Practices                 |
| 2. CGP   | Construction General Permit               |
| 3. CSMP  | Construction Site Monitoring Program      |
| 4. CASQA | California Stormwater Quality Association |

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

- 5. EPA Environmental Protection Agency
- 6. ELAP Environmental Laboratory Accreditation Program
- 7. NOI Notice of Intent
- 8. NOT Notice of Termination
- 9. COI Change of Information
- 10. MS4 Municipal Separate Storm Sewer System
- 11. NPDES National Pollution Discharge Elimination System
- 12. QSD Qualified SWPPP Developer
- 13. QSP Qualified SWPPP Practitioner
- 14. LRP Legally Responsible Person
- 15. PRD Permit Registration Documents
- 16. FMFCD Fresno Metropolitan Flood Control District
- 17. SMARTS Stormwater Multiple Application and Report Tracking System
- 18. SWPPP Storm Water Pollution Prevention Plan
- 19. SWRCB State Water Resources Control Board
- 20. RWQCB Regional Water Quality Control Board

### 1.2 REFERENCES

- A. Construction General Permit:
  - 1. 2022-0057-DWQ Construction General Permit
  - 2. [https://www.waterboards.ca.gov/water\\_issues/programs/stormwater/construction/general\\_permit\\_reissuance.html](https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction/general_permit_reissuance.html)
- B. Project SWPPP Document
  - 1. Available on SMARTS once approved by SWRCB
  - 2. Available by request from the Owner.
- C. CASQA Construction BMP Handbook:
  - 1. <https://www.casqa.org/resources/bmp-handbooks>
  - 2. Appendix G of the Project SWPPP.

### 1.3 RELATED SECTIONS

- A. Section 31 11 00 – Site Clearing
- B. Section 31 20 00 – Earthwork
- C. Section 33 41 00 – Storm Drainage
- D. Section 44 11 13 – Fugitive Dust Control

### 1.4 SUBMITTALS

- A. All submittals shall be in accordance with the submittal requirements of these specifications.
- B. The Contractor shall provide, to the Owner and QSD, the name, certification number, and contact information of their retained QSP within 30 days of starting construction.
- C. The Contractor shall provide to the Owner and QSD, completed training records of QSP

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

delegation to the Contractor within 30 days of starting construction.

- D. The Contractor shall submit to the Owner and QSD the proposed product to be used at the site as soil binder or tackifier for the purposes of erosion control for approval.
- E. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical results from the laboratory.
- F. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD the dewatering field sampling results in the form of the Effluent Sampling Field Log within five days of an NAL exceedance for pH or turbidity.
- G. The Contractor shall provide, to Owner and QSD, documentation of implementing all SWPPP requirements, for each Annual Report, within 30 calendar days of the end of each reporting period (reporting period is July 1 through June 30 of each year), or upon requesting to terminate the Project SWPPP.
- H. Upon request from the Owner or Owner's agents, Contractor shall provide all documentation that is required throughout construction including, but not limited to, CSMP records, sampling records, non-stormwater spill and discharge events, rain logs, QSP-signed inspection reports for delegated reports, and completed QSP delegation training records.

### 1.5 REQUIREMENTS

- A. General:
  - 1. Contractor is responsible for understanding and carrying out all provisions of the SWPPP, CGP, and any requirements from local agencies (except as excluded above in 1.1.B., where Owner responsibilities are specified).
  - 2. The requirements of the CGP, SWPPP, MS4 permittee, and any other local regulations related to stormwater pollution prevention shall be reviewed by Contractor, prior to initiating any ground disturbance or other activities that could lead to stormwater pollution, for a full understanding of the intent, objectives, and implementation.
  - 3. Contractor responsibilities begin immediately upon execution of the contract containing these specifications and continue until the SWPPP has been terminated with SWRCB.
  - 4. Specific requirements include, but are not limited to:
    - a. Daily weather monitoring and record keeping to identify upcoming storm events and required qualifying precipitation event-related inspections.
    - b. Installation of an on-site rain gauge and daily rain gauge reading recording.
    - c. Installation, implementation, and maintenance of BMPs, and prevention of prohibited activities and unauthorized non-stormwater discharges.
    - d. Conducting and reporting to the QSD all non-visible pollutant release sampling and dewatering sampling.
    - e. Ensure that all subcontractors and agents are trained to understand and implement their relevant responsibilities under the CGP, SWPPP, and these specifications.
    - f. Pay any penalties, fines, and corrective action costs resulting from failure to comply with SWPPP, CGP, and local agency requirements, and hold the

Owner/LRP harmless from any such failures.

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## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

6. The Contractor or QSP shall report analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical results from the laboratory.
- D. De-watering discharge sampling
1. Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP and Section 7 of the Project SWPPP.
  2. The Contractor, QSP, or QSP trained delegates shall notify the Regional Water Quality Control Board via email 24-hours prior to the start of planned dewatering operations.
  3. The Contractor, QSP, or QSP Delegates shall notify the QSD and LRP if dewatering sample results yielded an NAL exceedance for pH or turbidity within 5 calendar days of the exceedance, including the completed Effluent Sampling Field Log.
  4. The Contractor shall immediately cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.
- E. The Contractor shall be responsible for achieving Final Stabilization, as defined by the CGP, for all areas disturbed by Project construction activities in order to terminate the SWPPP within 90-days of completing construction activities, including areas without landscaping plans.
1. The Contractor shall re-establish any existing vegetation disturbed by the Project with the same vegetation type as was disturbed.
  2. The Contractor shall achieve Final Stabilization for all graded areas with no landscaping plan and disturbed pre-existing non-landscaped vegetation disturbed by the Project with either non-vegetative stabilization as defined by the CASQA Construction BMP Handbook or by use of seeding/hydroseeding with a native erosion control seed mix.
- F. The Contractor shall be fully aware of the requirements for the full execution of the SWPPP; the requirements of these specifications for implementing, maintaining, and enforcing the provisions of the SWPPP; and the impact that the SWPPP will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with the CGP is a violation of federal and state law. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Permit arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Permit requirements.

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

### 1.6 QUALITY ASSURANCE

#### A. Certified SWPPP Professionals:

1. Qualified SWPPP Developer (QSD)
  - a. The Owner shall retain a certified QSD.
  - b. The QSD's name, certification number, and contact information shall be listed within the SWPPP document.
2. Qualified SWPPP Practitioner (QSP)
  - a. The Contractor shall retain a certified QSP.
  - b. The QSP's name, certification number, and contact information shall be provided to the Project QSD and in the on-site SWPPP.

#### B. Regulatory Requirements:

1. Contractor shall comply with the lawful requirements of any applicable municipality, county, drainage district, municipal storm water management program and other local agencies regarding discharges of storm water to separate storm drain system or other watercourses under their jurisdiction, including but not limited to the following:
  - a. EPA Environmental Protection Agency.
  - b. FMFCD Fresno Metropolitan Flood Control District
  - c. SWRCB State Water Resources Control Board.
  - d. RWQCB Regional Water Quality Control Board.
2. All stormwater compliance shall be in accordance with local regulations:
  - a. Fresno Metropolitan Flood Control District (FMFCD).
  - b. County of Fresno.
  - c. City of Fresno.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Best Management Practices (BMPs):

1. The Contractor is responsible for the providing and furnishing all BMPs, products, and practices necessary to comply with the SWPPP and CGP. All materials and BMPs shall follow the CASQA Construction BMP Handbook and installed as described within the fact sheets, unless otherwise instructed by a qualified professional.
2. The Contractor must provide, implement, and carry out all BMPs required to comply with the CGP, regardless of the BMPs contained in the SWPPP, and shall notify Owner and QSD of any conflicts between the SWPPP and CGP.
3. The Contractor shall comply with the erosion control BMP requirements of the CGP, stating that BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days (CGP Appendix D Section II.D.f).
4. Prior to substantially altering BMPs recommended in the SWPPP, Contractor shall notify the Owner and QSD for review of the alternative BMPs and to obtain instructions for documenting the changes.
5. Contractor shall consult with the QSP to ensure all BMPs are appropriate, feasible, effective, and correctly implemented.

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

### PART 3 - EXECUTION

#### 3.1 FIELD QUALITY CONTROL

A. Monitoring by the Contractor's QSP:

1. Implement the CSMP and document all records in the SWPPP as required by the CGP, including, but not limited to: weekly, pre-storm, during-storm, post-storm, and quarterly inspections, daily weather monitoring, training of responsible contractor and subcontractor personell, and incidental non-visible pollutant discharge sampling.
  - a. CSMP inspection reports:
    - 1) The QSP or QSP trained delegates shall include photographs showing all disturbed areas, BMPs, BMP deficiencies, material storage locations, stormwater containment areas, and active construction areas. All photographs shall include comments noting any BMP corrective actions and completed corrective actions.
    - 2) The QSP or QSP trained delegates shall document in their CSMP Inspection reports when all outdoor construction activities have ceased.
  - b. QSP Training Records:
    - 1) The QSP or QSP trained delegates shall administer and document training of contractor and subcontractor staff responsible for BMP implementation, instillation, and maintenance and document it in the SWPPP.
    - 2) If QSP delegates any weekly/during storm inspections and/or non-visible pollutant discharge sampling requirements to Contractor personnel, QSP shall provide and document training to those personnel.
      - a) If CSMP inspection shave been delegated, the QSP shall review and sign all documentation completed by the trained QSP delegate.
  - c. Weather Monitoring:
    - 1) The QSP or QSP trained delegates shall save records of daily weather monitoring of the nearest NOAA weather station.
    - 2) The QSP or QSP trained delegates shall record the daily on-site rain gauge reading and retain the records for the duration of the Project.
  - d. Incidental Non-Visible Pollutant Discharge Sampling:
    - 1) The QSP or QSP trained delegates shall perform any stormwater and non-stormwater sampling, as required by the CGP. If any samples are sent offsite for laboratory analysis, QSP will identify a designated ELAP-certified laboratory and coordinate sample procurement, transportation, analysis, and recordkeeping. If QSP delegates any of these duties to Contractor personnel, QSP shall provide training and document the training in the SWPPP. QSP shall upload sampling results to SMARTS.
  - e. De-watering Discharge Sampling
    - 1) Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP. The Contractor shall cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

of turbidity or pH when resuming dewatering operations.

- f. The QSP shall consult with the Contractor to understand the construction schedule and identify site areas where erosion control BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days in accordance with CGP Appendix D Section II.D.f.
  2. New CSMP records outlined above in Part 3, Section 3.1.A shall be provided by the QSP to the QSD and Owner on a bi-monthly basis while the SWPPP NOI is active. New CSMP records shall be sent in the first week of odd numbered months.
  3. The QSP shall identify required amendments to the SWPPP based on construction activity and notify the QSD and Owner.
  4. The QSP shall identify when the site area has achieved “final stabilization” per the CGP definition, and inform the QSD and Owner.
  5. The Contractor’s QSP shall advise the Contractor on achieving final stabilization of all areas disturbed by the Project within 90-days of outdoor construction activities ceasing. The Contractor shall be responsible for achieving final stabilization, as defined by the CGP, for all areas disturbed by Project activities, including areas without landscaping plans.
  6. For the full monitoring requirements refer to the SWPPP and CGP.
- B. Monitoring by Owner
1. The Owner has the right to monitor and oversee the Contractor’s implementation and maintenance of the BMPs and SWPPP.
  2. Should the Owner determine that the Contractor’s efforts fail to meet the requirements of the CGP and the SWPPP, the Owner reserves the right to employ any and/or all of the following actions:
    - a. Notify the SWRCB of the perceived failure of the Contractor to comply with the CGP and SWPPP.
    - b. Withhold an amount of money from the Contractor’s Payment Request, equal to the Owner’s estimate of the value of the work required to implement and maintain the required BMPs, as well as provide the required inspection, training, and testing forms.
    - c. If the SWPPP is not terminated within 90-days of outdoor construction activities ceasing, withhold monies due the Contractor under this Contract, in an amount sufficient to complete the work, pay any additional fees due the State, and close out the SWPPP in compliance with the General Permit.
- C. Availability and access to the SWPPP:
1. As required by the SWPPP and CGP, the Contractor shall keep a minimum of one copy of the SWPPP, addenda, all PRDS, all inspection reports and all SWPPP records in the following locations:
    - a. Contractor’s Project Site Field Office.
    - b. Contractor’s General Business Office.
  2. The SWPPP shall be made available for public inspection at any time during normal business hours.
  3. All SWPPP records shall be made available to the Owner and their agents when requested.

### 3.2 CLEANING AND REMOVAL

#### A. Removal of BMPs

1. All temporary BMPs shall be completely removed from the Project Site prior to filing of the NOT.

## STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

2. The removal of any and all BMPs shall be coordinated and approved by the Contractor's QSP.
  3. All permanent BMPs shall remain on the Project Site, unless directed otherwise by Owner. The Owner will be responsible for ongoing inspection and maintenance after final acceptance.
- B. Under written agreement and with the approval of the Owner, the Contractor may assign maintenance and removal responsibilities of the project BMPs to a subsequent Contractor for later work phases at the Project Site.

### 3.3 RECORD KEEPING

- A. Paper and electronic records of all CSMP inspections, testing, training reports, all PRDs, inspection records, site photos, and all other SWPPP related records, shall be retained for a period of at least three years after the close of construction. These records shall be available at the project site until construction is completed.

### 3.4 PAYMENT

- A. Full compensation for all costs involved in implementing, and monitoring the implementation of the SWPPP for this project, including inspections, testing, and training, performing corrective measures as required to better implement the SWPPP, providing all labor, materials, and resources to maintain the SWPPP and all required records of the SWPPP, and being full liable for all failures to fulfill the intent and requirements of the CGP set forth by the SWRCB, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

## SECTION 01 64 00 – OWNER-FURNISHED ITEMS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all materials, labor, equipment, and services necessary to prepare for installation for those items, noted or scheduled within the Contract Documents, indicated as follows:
    - a. CFCI - Contractor Furnished, Contractor Installed
    - b. OFCI - Owner Furnished, Contractor Installed
    - c. OFOI - Owner Furnished, Owner Installed
    - d. OFVI - Owner Furnished, Vendor Installed
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- A. Unless otherwise defined in the GENERAL CONDITIONS, the following definitions apply for this project:
  - 1. CFCI: CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
    - a. When and if the indication "CFCI" is noted on the drawings or listed in the specifications, such items are shown or listed for information and will be furnished by and installed by the Contractor. Such a designation is listed only for clarity, in order to set the item(s) apart from the OFCI, OFOI, and OFVI related item(s).
    - b. All item(s) shown or listed in the drawings and specifications without any indication are in the Contract and are part of the Work unless specifically noted otherwise.
  - 2. OFCI: OWNER FURNISHED, CONTRACTOR INSTALLED
    - a. When and if the indication "OFCI" is noted on the drawings or listed in the specifications, such item(s) are shown or listed for information and will be furnished by Owner and installed by the Contractor. The Contractor shall coordinate and verify all dimensions and details necessary for the proper installation.
  - 3. OFOI: OWNER FURNISHED, OWNER INSTALLED
    - a. When and if the indication "OFOI" is noted on the drawings or listed in the specifications, such item(s) are shown or listed for the purpose of general information and will be furnished and installed by Owner. The Contractor shall coordinate and verify all dimensions and details necessary for proper installation.
  - 4. OFVI: OWNER FURNISHED, VENDOR INSTALLED
    - a. When and if the indication "OFVI" is noted on the drawings or listed in the specifications, such item(s) are shown or listed for information and will be furnished by the Owner and installed by the Vendor. The Contractor shall coordinate and facilitate all work to be completed by the Vendors.

### 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Coordination Drawings:
    - a. Submit installer's coordination drawings or other documents indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
    - b. The Owner will provide Product Data, Shop Drawings, Piping and Wiring Diagrams, Catalog Data Sheets for any items provided under this Specification Section.
  - 2. Closeout Submittals in accordance with Specification Sections in Division One:
    - a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.

### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA). Regulatory changes may affect the formulation, availability, or use of the specified coatings. Confirm availability of coatings to be used prior to use, and notify the Architect of any recent changes in the Local California Air District Standards where the Project is located, that may have occurred after the preparation of this specification section.
- B. Meetings:
  - 1. Progress Meetings: Scheduled by the Contractor for the proper performance of the work.
    - a. Minimum agenda shall be to review the work progress; discuss field observations, problems, and decisions; identification of any potential problems which may impede planned progress; corrective measures to regain projected schedules; and maintenance of quality and work standards in accordance with manufacturer's warranty requirements.
  - 2. Final Inspection: Scheduled by the Contractor upon proper completion of the work.
    - a. Minimum agenda shall be a walkover inspection to identify problems which may impede the issuance of any warranties or guarantees, and discussion of maintaining the work until substantial completion notice for the project is filed.
  - 3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:
    - a. Contractor.
    - b. Owner.
    - c. Architect.
    - d. Installer.
    - e. Material Manufacturer(s).
    - f. Subcontractors, as appropriate (including any accessory subcontractors).

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted. Contractor shall inspect prior to unloading, for any damaged goods, and if OK, will allow unloading and be responsible for the goods.
- B. Acceptance at Site:
  1. The Contractor shall accept delivery of any items and the responsibility for all items to be furnished to him by the Owner.
- C. Storage and protection:
  1. Owner Furnished Equipment: The Owner will coordinate and inform the Contractor as to delivery dates for Owner Furnished Equipment to the Project Site. The Contractor shall be responsible for unloading, uncrating, and protecting such equipment.
  2. When only a supporting device, or sub-assembly is to be installed by the Contractor the Owner shall provide only that portion and shall store and safeguard those portions to be installed later by others.
  3. All products shall be protected, handled, and stored in complete compliance with the manufacturer's printed instructions to protect the Owner from warranty infringements or loss of the full function of the item specified.

## 1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions:
  1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  2. Examine all preparatory work to determine its suitability and completeness. Notify the responsible Contractor of any deficiencies which must be corrected prior to installation.
  3. Be satisfied that all conditions affecting installation, operation or function are suitable for installation of the items scheduled.
  4. After installation, and acceptance by the inspector and the Architect, the Contractor shall provide protective guards, covers or barricades as required by the manufacturer.
  5. The Contractor shall promptly repair, refurbish, or replace items damaged by his operations to a condition satisfactory to the Owners representatives and at no cost to the Owner.

## 1.7 WARRANTY

1. The Contractor shall provide access to the installed items or prepared substrates for the inspection of the manufacturers representatives, for the purpose of affirming the warranties scheduled.
2. All work shall be performed in full accordance with the manufacturers warranty requirements and all governing codes.

## PART 2 - PRODUCTS

NOT APPLICABLE



## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
    - a. Prepare all substrate blocking as required by the items Furnished By Owner.
    - b. Prepare all wiring and piping connections as required by the items Furnished By Owner.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond or installation of materials specified within the Contract Documents.

## 3.2 INSTALLATION

- A. General:
  - 1. In accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
  - 2. In accordance with approved submittals.
  - 3. In accordance with Regulatory Requirements.
  - 4. Set plumb, level, and square.
- B. Layout:
  - 1. Lines shall be straight and true.
- C. Material and Equipment to be installed:
  - 1. All items so noted or scheduled to be OFCI shall be unloaded, completely installed and placed in operable condition under this Contract.

## 3.3 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces at the end of each day, minimum.
  - 2. In accordance with manufacturer's instructions and recommendations.

END OF SECTION

## SECTION 01 71 23 – FIELD ENGINEERING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This section includes the following: Section includes requirements governing execution of the work including, but not limited to, the following:
  - a. Construction layout
  - b. Field engineering and surveying
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS
  - 2. DIVISION 01 SPECIFICATION SECTIONS
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with specification section – SUBMITTAL PROCEDURES:
  - 1. Coordination Drawings:
    - a. Utility Coordination Drawing(s).
  - 2. Quality Assurance/Control Submittal:
    - a. Qualification Data for Civil Engineer/Surveyor.
    - b. Intermediate Certificate of Survey Compliance.
    - c. Final Certificate of Survey Compliance.
  - 3. Closeout Submittals in accordance with the following:
    - a. As-built Survey Drawing(s).
    - b. Project "Record" Survey Drawing.

## 1.3 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Civil Engineer/Surveyor Qualifications:
    - a. A professional Civil Engineer or Land Surveyor who is licensed to practice in the State of California.
    - b. Has successfully completed three (3) projects of similar scope and size to that indicated for this project.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section – REGULATORY REQUIREMENTS and the following:
    - a. CARB Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board and the Environmental Protection Agency (EPA), in the area where the project is located.
    - b. CF County of Fresno, codes and ordinances.
- C. Certificates:
  - 1. Intermediate Certificate of Survey Compliance:

- a. Provide certification letter on contractor's letterhead stating the project complies with the requirements of the contract documents at the completion of building pad construction and installation of underground utilities outside of building pads is complete. Certification letter must be stamped and signed by the qualified Civil Engineer/Surveyor.
2. Final Certificate of Survey Compliance:
  - a. Provide certification letter on contractor's letterhead stating the project complies with the requirement of the contract documents at the completion of all above ground improvements and finish grading.
- D. Meetings:
  1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with all other related work.
    - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
    - b. Maintain installed work until the Notice of Substantial Completion has been filed.

#### 1.4 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Existing Conditions:
  1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

#### PART 2 - PRODUCTS

NOT APPLICABLE

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

- A. Existing Conditions:
  1. The existence and location of underground utilities indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence, location, and elevation of all underground utilities and other construction affecting the Work.
    - a. Call a local utility locator service (such as USA – "Underground Service Alert") for the task of locating any project related utilities.
    - b. Verify the location and invert elevation at points of connection of sanitary sewer system and storm drainage system.

- c. Accurately document vertical and horizontal measurements and elevations uncovered or verified.
- B. Coordination:
  - 1. Before proceeding to lay out the Work, verify layout information shown on the drawings in relation to the property survey, topographic survey, and existing benchmarks.
  - 2. Drawings have been provided showing improvements and underground systems for foundations, storm drainage, sewer, water, gas, mechanical lines, electrical lines, and site improvements. Coordinate and verify the accuracy of the drawing locations and elevations as they relate to each other, with existing utility lines, and building pad earthwork zones of influence.
    - a. Provide 1"=20' scaled and dimensioned Utility Coordination Drawing.
    - b. No improvements shall be executed until the Utility Coordination Drawing is reviewed by the Architect for general conformance with the Contract Documents.
  - 3. Coordinate Layout of Work performed under other sections of the Specifications.
  - 4. If layout conflicts are encountered, report to Architect and then prepare recommendation(s) for correction.
  - 5. Close and careful coordination is required between work of the Contract and that of any future work to follow.
  - 6. Work under this Contract shall accommodate the installation of future work.

### 3.2 PREPARATION

- A. Existing Utility Information:
  - 1. Furnish information to public utilities that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

### 3.3 CONSTRUCTION

- A. Layout of Work:
  - 1. Engage a Civil Engineer/Surveyor to Layout the Work using accepted surveying practices and be responsible for all reference points, benchmarks, lines, elevations, and measurements required for Work under this Contract.
  - 2. Reference points:
    - a. Locate existing permanent benchmarks, control points, and similar reference points before beginning the work.
    - b. Do not change or relocate existing benchmarks or control points without approval of the Architect.
    - c. Replace lost or destroyed permanent benchmarks and control points. Base replacements on the original survey control points.
  - 3. Benchmarks:
    - a. Establish and maintain a minimum of two (2) permanent benchmarks on the project site, referenced to data established by survey control points.
    - b. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
    - c. Use established benchmarks and control points to set lines and levels at each floor of construction and elsewhere as needed to locate each element of the Project.
  - 4. Locate construction access to site parking, storage areas, and temporary facilities and controls.

5. Locate and layout control lines and levels for structures, foundations, column and wall grids, and floor levels including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels.
  - a. Level foundations and piers from two or more locations.
6. Locate and layout site improvements, including pavement, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
7. Inform installers of lines and levels to which they must comply.
8. Check the location, level, and plumb of every major element as the Work progresses.
9. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.4 FIELD QUALITY CONTROL

- A. Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the Inspector and Architect.
- B. Maintain As-built Survey Drawing(s) of all underground, surface, and above ground improvements and grades with measurements for both vertical and horizontal dimensions.
  1. Record all addendum and issued change documents.
  2. Upon project completion stamp and sign As-built Survey Drawing(s).
- C. Check documented measurements and elevations at completion of building pads and underground utilities against contract documents. The Contractor shall correct out of compliance Work before proceeding with the next element of Work. As-built Survey Drawing(s) shall be current. When all Work at this stage is in compliance with the contract documents, issue the Intermediate Certificate of Survey Compliance.
- D. Check documented measurements and elevations at completion of finish grading and site improvements, except for landscape and irrigation work, against contract documents. The Contractor shall correct out of compliance Work before proceeding with the next element of Work. As-built Survey Drawing(s) shall be complete. When all Work at this stage is in compliance with the contract documents, issue the Final Certificate of Survey Compliance.
- E. The Civil Engineer/Surveyor shall prepare Project "Record" Survey Drawing in accordance with Specification Section - PROJECT DOCUMENTS.
  1. The Project "Record" Survey Drawing shall contain all of the vertical and horizontal measurements and elevations of reference points, benchmarks, utility lines, grade contours, grade breaks, building floors, major vegetation, and sitework improvements.
  2. The Project "Record" Survey Drawing shall be stamped and signed by the qualified Civil Engineer/Surveyor.
  3. The As-built Survey Drawing(s) shall be used in preparation of the Project "Record" Survey Drawing.

### 3.5 PROTECTION

- A. Preserve and protect permanent benchmarks, control points, reference points, and staking during construction operations.

END OF SECTION

## SECTION 01 73 29 – CUTTING AND PATCHING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary for cutting and patching existing materials, accessories and other related items necessary to remodel the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of Work.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Coordination Drawings:
    - a. Submit any installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.

## 1.4 QUALITY ASSURANCE

- A. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades.
  - 1. Review areas of potential interference and conflict.
  - 2. Coordinate procedures and resolve potential conflicts before proceeding.
- B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. The Contractor shall do all cutting, fitting or patching of existing construction and his work as may be required to make the several parts come together properly and ready to receive or be received by work of other contractors as shown, or reasonably implied by the drawings and specifications for the completed structure. All work shall be as directed by the Architect to achieve the intended work and degree of finish shown.
- F. Any cost caused by defective or ill-timed work shall be borne by the party responsible therefor.

## 1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

### 3.3 FIELD QUALITY CONTROL

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill. **Do not overcut concrete corners** – hand chip all corners to prevent over-cutting lines. Cut any masonry pavers at grout lines, and **don't overcut** into adjacent brick that is to remain.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Grinding and Sandblasting: Where grinding and sandblasting is required of existing construction, perform in accordance with industry standards for proper preparation of new construction or finishes.
- D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. All hard paving and walk replacement shall be flush with adjacent existing construction. Compact existing subgrade so that there is no settling of adjacent horizontal surfaces greater than 1/4", and that all surfaces are ADA compliant.
    - b. When altering surfaces in brick paving, match nearby adjacent horizontal concrete surfaces in color and texture. Take care to protect adjacent brick surfaces from concrete slurry and finishing operations. Clean exposed surfaces of brick immediately so that no signs of adjacent concrete work is seen.



- c. Match existing adjacent exposed aggregate concrete paving (color and texture) when construction is proposed for areas paved with exposed aggregate concrete.
    - d. Match existing adjacent colored concrete paving (color and texture) when construction is proposed for areas paved with colored concrete.
  - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  - 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- E. Insert specific installation requirements if not specified elsewhere. Specific installation requirements are better specified in individual Sections.

END OF SECTION

**SECTION 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This section includes the following:
  - 1. Requirements governing execution of the work including, but not limited to, the following:
    - a. Salvaging non-hazardous demolition waste.
    - b. Recycling non-hazardous construction and demolition waste.
    - c. Disposing of non-hazardous construction and demolition waste.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS
  - 2. DIVISION 01 SPECIFICATION SECTIONS
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP

**1.2 DEFINITIONS**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, modernization, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition and site clearing operations.
- C. Disposal: Removal off-site of construction and demolition waste and subsequent sale, recycling, reuse, or deposit in landfill acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of construction or demolition waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of construction or demolition waste and subsequent sale or reuse in another facility.

**1.3 SYSTEM DESCRIPTION**

- A. Performance Requirements
  - 1. General:
    - a. Achieve end-of-project rate for salvage/recycling of minimum [65][75][90] percent by weight of total non-hazardous construction and demolition waste generated by the Work.
    - b. Practice efficient waste management in the use of materials in the course of the Work.
    - c. Use all reasonable means to divert construction demolition waste from landfills and incinerators.

1.4 SUBMITTALS

A. Submit in accordance with Specification Section – SUBMITTAL PROCEDURES:

1. Quality Assurance/Control Submittal:
  - a. Waste Management Plan.
  - b. Waste Management Progress Reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
  - a. CARB Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board and the Environmental Protection Agency (EPA), in the area where the project is located.
  - b. CAL/OSHA California Division of Occupational Safety and Health Administration.
  - c. CF County of Fresno, codes and ordinances.
  - d. EPA Environmental Protection Agency.

B. Waste Management Plan:

1. Prior to commencing the Work, submit Waste Management Plan. The Plan must include, but not limited to, the following:
  - a. Contractor's name and project identification information.
  - b. Procedures to be implemented.
  - c. Materials to be salvaged, recycled, or disposed.
  - d. Estimated quantities of material broken down by material categories.
  - e. Names and locations of entities who receive salvaged and recycled materials.
  - f. Tonnage calculations that demonstrate that the Contractor will salvage, re-use, or recycle the minimum percentage by weight of the construction and demolition waste materials generated by the Work.

C. Waste Management Progress Reports:

1. Submit the Report with each application for progress payment.
  - a. Failure to submit the Report and it supporting documentation can render the application for progress payment incomplete and delay the progress payment.
2. Each Report must include, but not limited to, the following:
  - a. List of material categories.
  - b. Weight quantity of waste by material category.
  - c. Weight quantity of waste salvaged.
  - d. Weight quantity of waste recycled.
  - e. Total weight quantity of salvaged and recycled waste by material category.
  - f. Weight percentage of waste salvaged and recycled by material category.
  - g. Include manifests, weight tickets, receipts, and invoices specifically identifying the salvaged, reused, and recycled materials.
  - h. Signature line for Contractor.

D. Meetings:

1. Pre- Demolition.....Schedule prior to the start of work.
  - a. Coordinate the work with other work being performed.

- b. Identify any potential problems, which may impede the proper disposal of materials.
  - c. Review areas where waste and recycle bins will be located.
  - d. Review where salvaged materials will be stored.
  - e. Review demolition waste disposal and material recycling procedures and environmental goals per Waste Management Plan with all subcontractors and waste haulers.
- 2. Progress:.....Scheduled by the Contactor during the performance of the work.
  - a. Review for maintaining proper procedures.
  - b. Inspect and identify any problems and acceptable corrective measures.
- 3. Completion:.....Scheduled by the Contactor upon proper completion of the work.
  - a. Inspect and identify any problems.
  - b. Submit final Progress Report summarizing total construction and demolition waste weights, percentages salvaged, recycled, and disposed.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Cleaning, handling, and packing:
  - 1. Salvaged Items shall be handled in such a manner as to assure that they are free from damage.
  - 2. Salvaged Items shall be cleaned and packed or cleaned and palletted before off-site transport.
- B. Storage and protection
  - 1. Salvaged Items shall be stored in a dry, protected area prior to transport.
  - 2. Cover with protective waterproof covering providing for adequate air circulation and ventilation.

#### 1.7 PROJECT CONDITIONS

- A. Environmental requirements;
  - 1. Comply with federal, state, and local regulations pertaining to solid waste, recycling, chemical waste, sanitary waste, and noise pollution.
  - 2. Perform work in a manner as to minimize the spread of dust and flying particles.
  - 3. No burning will be allowed on-site.
- B. Existing conditions:
  - 1. Examine project site and building(s) and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  - 2. Conduct work so as not to interfere unnecessarily with adjacent buildings, roads, streets, drives, and walks.
    - a. Do not close or obstruct streets, alleys, walks, or passageways without permission from authorities having jurisdiction and coordinating same with immediate neighbors whose business operation may be affected.
    - b. Safety measures shall be taken to insure an uninterrupted flow of traffic around the site as required by local Police and Fire Departments.

3. Storage or sale of removed items on-site is not permitted.
4. It is not expected that hazardous materials will be encountered in the Work.
  - a. Hazardous materials will be removed and disposed of by Owner prior to start of the Work.
  - b. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
5. Hazardous materials are present in buildings and structures to be selectively demolished. The Owner has prepared a report for the Contractor to review and use.
  - a. Hazardous material remediation is specified in Specification Section - HAZARDOUS MATERIAL PROCEDURES.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Furnish all materials, tools, equipment, facilities, and services as required for performing the construction and demolition waste disposal work.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of conditions:
  1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  2. Execution of work under this specification section shall constitute acceptance of existing conditions.
  3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the Work under this Section.

### 3.2 PREPARATION

- A. Coordination:
  1. Before proceeding, verify plans match existing conditions.
  2. Review documents of existing construction provided by Owner against existing conditions.
  3. If conflicts are encountered, report it to the Architect. Then prepare recommendation(s) for correction and submit to Architect for review.
  4. Coordinate work under this specification section with work specified under other sections.
- B. Protection:
  1. Property:
    - a. Provide temporary weather protection to prevent damage to salvage and recycled items.
    - b. All damage inflicted on public and private property and the property of the Owner shall be repaired or restored to the original condition prior to the start of this Work. All repair or replacement work shall be done at no additional cost to the owner.

### 3.3 IMPLEMENTATION

#### A. General:

1. Implement waste management plan as submitted.
2. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the contract.
3. Designate and label specific areas on project site necessary for separating materials that are to be salvaged, recycled, reused, and donated.

#### B. Demolition Waste:

1. Salvaged items for delivery to Owner or other entity:
  - a. Clean salvaged items.
  - b. Pack or crate items after cleaning. Identify contents of containers.
  - c. Store items in a secure area until pick-up or delivery to Owner.
  - d. Transport item to Owner's storage area [on-site][off-site][list address].
  - e. Protect items from damage during transport and storage.
2. Salvaged items for reuse in the work:
  - a. Clean salvaged items.
  - b. Store items in a secure and dry area until ready for installation.
3. Recyclable materials:
  - a. Prepare and maintain recyclable waste materials according to recycling facility requirements.
  - b. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
  - c. Separate recyclable demolition waste from other waste materials. Separate recyclable waste by material type at project site to the maximum extent practical according to approved waste management plan.
  - d. Separate recyclable demolition waste from other waste materials. All recyclables may be co-mingled into one bin and separated off-site at the appropriate recycling facility.
    - 1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from the project site.
    - 2) Include a list of acceptable and unacceptable materials at each container or bin.
    - 3) Inspect containers and bins for contamination and remove contaminated materials if found.
    - 4) Processed materials stockpiled on site shall not be mixed with other materials. Shape stockpiles to drain surface water. Cover stockpiles to prevent windblown dust.
    - 5) Processed material shall be stockpiled away from construction. Do not stockpile within drip line of remaining trees.
  - e. Remove recyclable demolition waste off project property and transport to recycling receiver or processor.
  - f. The following list is of common material types which can be recycled. The list of material types is in no way complete but is representative of materials that can be sorted and recycled as per the intent of this specification section.
    - 1) Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

- 2) Wood: Sort and stack members according to size, type, and length of member.
  - 3) Metals: Separate metal by type. Stack structural steel members according to size and length. Remove bolts, nuts, washers, and other hardware from members.
  - 4) Gypsum Board: Stack large clean pieces on wood pallets in a dry location. Remove edge trim and sort with other metals.
  - 5) Acoustical Ceiling Tile: Stack large clean pieces on wood pallets in a dry location.
  - 6) Metal Suspension System: Separate metal members including trim and other metals from acoustical ceiling tile and sort with other metals.
  - 7) Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and any tack strips. Store carpet in a dry location.
  - 8) Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
  - 9) Conduit: Reduce conduit to straight lengths and store by type and size.
4. Site clearing waste:
- a. Excavated top soil and land clearing debris not recycled and reused on-site shall be removed to an off-site recycling location or disposed of at a landfill that accepts inert material.
- C. Construction Waste:
1. Recyclable materials:
    - a. Prepare and maintain recyclable waste materials according to recycling facility requirements.
    - b. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
    - c. Recycle paper and beverage containers used by on-site workers.
    - d. Separate recyclable construction waste from other waste materials. Separate recyclable waste by material type at project site to the maximum extent practical according to approved waste management plan.
    - e. Separate recyclable construction waste from other waste materials. All recyclables may be co-mingled into one bin and separated off-site at the appropriate recycling facility.
      - 1) Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from the project site.
      - 2) Include a list of acceptable and unacceptable materials at each container or bin.
      - 3) Inspect containers and bins for contamination and remove contaminated materials if found.
    - f. Remove recyclable construction waste off project property and transport to recycling receiver or processor.
    - g. The following list is of common material types which can be recycled. The list of material types is in no way complete but is representative of materials that can be sorted and recycled as per the intent of this specification section.
      - 1) Cardboard Packaging: Breakdown into flat sheets. Bundle and store in a dry place.

- 2) Polystyrene Packaging: Separate and bag materials.
- 3) Pallets: As much as possible, require deliveries using pallets to remove pallets from the project site. For pallets that remain on-site, breakdown pallets into component wood pieces and comply with requirements for recycling wood.
- 4) Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- 5) Wood: Clean cut-Offs of lumber and grind or chip into small pieces.
- 6) Gypsum Board: Stack large clean pieces on wood pallets in a dry location.

D. Disposal of Waste:

1. Except for items or materials to be salvaged, recycled, or otherwise reused remove and transport waste materials from project site and legally dispose of them in a manner acceptable to authorities having jurisdiction.
2. Do not allow waste material to accumulate on site.
3. Transport waste in a manner that will prevent spillage on adjacent surfaces and areas.

3.4 CLEANING

1. Clean in accordance with Specification Section – PROJECT CLOSEOUT:
  - a. Immediately clean any soiled surfaces to remain.

END OF SECTION



## SECTION 01 77 20 – PROJECT CLOSEOUT

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.
- C. Work Included:
  - 1. Project cleanup and coordination of all cleaning work required under all sections of this specification.
  - 2. Collection of and processing for delivery to the Architect of all Project Record Drawings required under this and other various Sections of the Specifications.
  - 3. Compile and assemble all required documents, operation data, maintenance manuals, and parts lists for all equipment items provided for this project.
  - 4. Start-up of all mechanical, electrical, and miscellaneous equipment items; and adjustment required for the performance specified.
  - 5. Compile and assemble all guarantees, warranties, or other written documentation to establish the requirements outlined under all sections of this specification.
  - 6. Repair and touch-up on all items damaged during the construction and handling processes.
  - 7. Furnish maintenance material and spare parts as specified within DIVISIONS 02 through 49 of these specifications.
  - 8. Deliver to the Architect all assembled copies of those items required in Articles 1 through 6 above for presentation to the Owner.
- D. It shall be the responsibility of the Contractor to provide all labor and materials necessary to achieve completion of the items listed under Paragraph A, B and C above, although certain items may be specified under the work of other trades. Periodic removal of debris, cleaning, repair, and testing of times in various areas of the construction site shall be carried out under the direction of the Contractor.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Quality Assurance/Control Submittals:
    - a. Design Data.
      - 1) All design data as required by the Contract Documents.
    - b. Test Reports:
      - 1) Submit four (4) copies of reports.

- 2) Submit four (4) copies of reports required by regulatory requirements.
  - 3) Submit four (4) copies of ICC Evaluation Service Report.
  - 4) Submit four (4) copies of Testing Laboratory's report.
  - 5) All other Test Reports as required by the Contract Documents.
- c. Certificates:
  - 1) Submit three (3) copies of certificates.
- d. Manufacturer's Instructions:
  - 1) Submit three (3) copies of manufacturer's instructions.
- e. Manufacturer's Field Reports:
  - 1) Submit three (3) copies of manufacturer's field reports.
- f. Engineering Calculations:
  - 1) Submit four (4) copies of engineering calculations computed and signed by a registered Civil or Structural Engineer in the State of California.
2. Closeout Submittals in accordance with Specification Sections in Division One:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - c. Warranty in accordance with Specification Section - WARRANTIES.
3. Project Record Documents:
  - a. Various Sections of the detailed specifications require Project Record Drawings to be prepared by the Contractor(s). These drawings shall be collected by the Contractor, checked for conformance to the specific requirements, and when completed, delivered to the Architect. The Contractor shall also be responsible for collecting bound operating and maintenance manuals required of all trades supplying equipment, and for delivering them to the Architect.
4. Documents Required for Project Certification
  - a. Compile and neatly assemble with indexed and labeled tabs, three (3) sets of the required documents for project certification by the State Agencies. The required documents include, but are not limited to, the following:
    - 1) Document Required List "Form" for Project Certification ORS-6.
      - a) This document shall be used to organize and index the required documents.
    - 2) Project Information "Forms":
      - a) Project Site Inspector(s) SSS-5.
      - b) In-Plant Inspector(s), required for re-locatable buildings only SSS-5.
      - c) Contract Information DSA-102.
    - 3) Final Verified Report "Forms" from the Architect and Engineers:
      - a) Architect's Final Verified Report DSA-6A/E.
      - b) Structural Engineer's Final Verified Report DSA-6A/E.
      - c) Mechanical Engineer's Final Verified Report DSA-6A/E.
      - d) Electrical Engineer's Final Verified Report DSA-6A/E.
    - 4) Final Verified Report "Forms" from the Contractor(s) and Inspector(s):
      - a) Project Site Inspector(s) Final Verified Report DSA-6.
      - b) Contractor(s) Final Verified Report DSA-6.
      - c) In-Plant Inspector(s) Final Verified Report DSA-6.
      - d) Special Inspector(s) Final Verified Report DSA-6.
    - 5) Other Final Verified Reports and Affidavits for:
      - a) Laboratory - To be signed by Licensed Professional Engineer.
      - b) Shop Welding and Fabrication - To be signed by AWS/CWI Welding Inspector
      - c) Field Welding - To be signed by AWS/CWI Welding Inspector
      - d) High Strength Bolt Installation
      - e) Glu-Laminated Fabrication

- f) Manufactured Trusses
- g) Masonry Inspection
- h) Engineered Fill - To be signed by the Geotechnical Engineer
- i) Bleacher Fabrication
- j) Other items required by the State Agencies
- 6) Notices, Certificates, and Change Orders
  - a) Notice of Completion - Signed by the Owner, Notarized and recorded with the County Records Office.
  - b) Weighmaster Certificate(s)
  - c) Automatic Fire Sprinkler System
  - d) Fire Alarm System Components
  - e) Fire Standpipe System
  - f) Fire Suppression System
  - g) Smoke Ventilation System
  - h) Skylight System
  - i) Bleacher System
  - j) Change Orders - Signed and fully executed.
  - k) Other documents and/or requirements required by the State Agencies
- 7) Field Visit Reports, Correction Reports, Punch Lists & Final Review Reports
  - a) Field Visit Reports from State Agencies
  - b) Field Visit Reports from Architect and Engineers
  - c) Inspector's Correction Reports
  - d) Contractor Punch Lists
  - e) Architect, Engineers and Owner Final Review Reports
  - f) A jointly signed and notarized Affidavit from the Contractor and Project Inspector (formerly the Inspector of Record), indicating that any and all items of correction noted in the above documents have been corrected (including Testing Laboratory Reports).

### 1.3 QUALITY ASSURANCE:

- A. Safety, Fire and Environmental Protection, and Insurance standards shall be strictly adhered to in all phases of the construction work. It shall be the responsibility of the Contractor to determine the standards applicable to this project as set forth in all codes, regulations, and ordinances having jurisdiction, and as set forth elsewhere in the Specifications.
- B. All specific requirements stipulated in, or required by code references included under all sections of DIVISIONS 02 through 49 inclusive of this specification, and as detailed under Article 3.4 of this Section, shall be required under this Contract.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Materials:
  - 1. Use only those specified materials or types of materials recommended and approved by the manufacturer of the item to be cleaned.
- B. Touch-Up Materials:

1. Use only those materials furnished by or as recommended and approved by the manufacturer of the item to be touched up. Colors and finish characteristics shall exactly match the base material and extra materials, labor, and services required to achieve this result shall be provided by the Contractor(s).
- C. Replacement Materials:
1. Materials that are damaged and not repairable, or materials that are destroyed shall be replaced with equal and identical materials of the same manufacture and shall function in conjunction with the remaining portions of that material. Items no longer manufactured or available shall be replaced with comparable materials as approved by the Architect and at no additional cost to the Owner.
  2. Materials that are required for maintenance replacement by the owner after the guarantee period has expired, or by the contractor during the guarantee period shall exactly match those materials installed as to make, style, color lot, etc., under this contract, and shall be delivered to the owner in marked, identified containers.
- D. Extra Materials:
1. Carefully examine the requirements of the applicable Sections of all DIVISIONS and specifically of DIVISION 09 and deliver the materials required to the Owner.

### PART 3 - EXECUTION

#### 3.1 REPAIR AND RESTORATION

- A. All damaged items shall be repaired and replaced as directed using proper materials and craftsmen skilled in that particular trade. Materials shall be as follows:
1. All repair or replacement parts shall be of the same equality and manufacturer as the item being repaired.
  2. All touch-up paint shall be as provided by the item manufacturer for that purpose and shall exactly match the original color and finish.

#### 3.2 FIELD QUALITY CONTROL

- A. Final Reviews:
1. In addition to all items covered under those Sections of Divisions 02 through 49 inclusive, the Contractor shall comply with the requirements stated herein.
    - a. The Contractor shall request in writing a final review (see Contractor's Request for Final Review form at the end of this Specification Section).
      - 1) The Contractor shall allow a forty-eight (48) hour time period of advance notification prior to the requested date and time indicated on the Review Request form.
      - 2) The Contractor represents that the work has been carefully inspected by the Contractor to determine that the work is complete and in compliance with all requirements set forth.
    - b. The Contractor shall prepare and shall submit the initial Contractor's Punch List identifying the items that remain uncompleted forty-eight (48) hours prior to the scheduled final review by the Architect.
    - c. Under no circumstances shall the Contractor ask the Architect or his representative to make these determinations for him.

2. The Architect shall review the initial Contractor's Punch List along with the Owner's Project Inspector, and determine together whether or not the Project is ready for final review. If approved, the Architect or its representative will make the final review on the date and time requested in the Contractor's Request for Final Review form, except under the following conditions:
  - a. Upon reviewing a portion of the Project and finding quantities of work incomplete or not in compliance, the review shall cease, and the Architect will notify the Contractor.
  - b. If the Contractor has assured the Architect of the completeness and/or accuracy of the work, and the review does not bear this contention out.
3. The above conditions will be adhered to rigidly to prevent the Architect from being required to act as a supervisory agent of the Contractor by being asked to determine the degree of completion,.
  - a. When the Contractor requests additional reviews, he shall reimburse the Architect for all time and expense incurred as indicated on the Contractor's Request for Final Review form at the end of this Specification Section.
  - b. The Architect is herein defined as any of those firms or individuals listed by references on the drawings, including all consultants identified herein.
  - c. All requests for Project Final Review (and re-review) shall be made in writing on the form provided at the end of this Specification Section.
4. When the Architect does approve of the degree of readiness for the Project based on the initial Contractor's Punch List and the readiness of the Project, the Architect will make his final review, adding to the Contractor's Punch List any other items that require further completion.
5. The Contractor shall take the initial Contractor's Punch List, together with the Architect's Punch List, and initial and date each item on each list as to when it was completed.
6. Once both lists are completed and signed by the Project Inspector, the Contractor shall submit to the Architect the completed lists for final review and approval prior to filing for Substantial Completion.

### 3.3 CLEANING

#### A. During Construction:

1. Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.
2. Sprinkle dusty debris with water.
3. At reasonable intervals during progress of work, clean up site and access and dispose of waste materials, rubbish, and debris.
4. Provide suitable containers and locate on site for collection of waste materials, rubbish, and debris.
5. Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.
6. Remove waste materials, rubbish and debris from the site and legally dispose of at public or private dumping areas off the Owner's property.
7. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.
8. Lower waste materials in a controlled manner with as few handling as possible; do not drop or throw materials from heights.
9. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

#### B. Final Cleaning:

1. Use experienced professional cleaners for final cleaning.

2. At completion of construction and just prior to acceptance or occupancy, conduct a final review of exposed interior and exterior surfaces.
3. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior surfaces.
4. Repair, patch, and touch-up marred surfaces to match adjacent finishes.
5. Broom clean paved surfaces; rake clean other surfaces of grounds.
6. Replace air conditioning filters if units were operated during construction.
7. Clean ducts, blowers, and coils if air conditioning units were operated during construction.
8. Maintain cleaning until the building, or portion thereof, is accepted by the Owner.

### 3.4 DEMONSTRATION

- A. During Construction and as each piece of equipment is installed, provide the following tests:
  1. Verify that all external service connections have been properly completed, and that piping and/or wiring is properly sized, and contain all necessary safety devices.
  2. Verify that the equipment is free of shipping materials, tie downs, or other internal obstructions.
  3. Conduct tests employing the manufacturer's operating instructions as a sequential guide.
  4. Verify that all portions of the equipment function properly and that the total performance criteria is satisfied.
  5. Make adjustments, replacements, or repairs necessary to achieve full operational capability and repeat tests until performance is achieved and approval obtained.
- B. Prior to acceptance, verify that all conditions specified in the Article titled FIELD QUALITY CONTROL, Final Review, have been satisfied and that equipment is ready for continuous use. Provide the following services preparatory to acceptance:
  1. Clean or replace all filters and/or strainers.
  2. Adjust all belts and drive mechanisms.
  3. Lubricate all moving parts as required by manufacturer's operating instructions.
  4. Demonstrate to the Owner's representative and the Architect or Engineer the method and sequence of operation, and provide testing devices and/or data to verify that performance equals that specified.
  5. Provide operating instructions in bound form along with manufacturer's parts list and written warranties.

### 3.5 SCHEDULES

- A. See next page for Request for Final Review from the Contractor(s):

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## 03/19/2024

## SECTION 01 78 36 – WARRANTIES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. In addition to providing all other warranties specified in the Project Manual and without affecting any rights of Owner under State or Federal law, Contractor shall warrant that the Work done under this Project Manual will be free from faulty materials or workmanship and hereby agrees, upon receiving notification from the Owner or his Agent, to immediately remedy, repair or replace, without cost to the Owners and to his entire satisfaction, all defects, damages or imperfections appearing in said work within a period of one (1) year unless specified otherwise, after date of final acceptance by the Owner of all work done under this Project Manual, regardless of whether or not the Owner or persons operating under contract with the Owner partially or wholly occupies any portion of the work prior to acceptance. For work performed after completion, the one (1) year period shall be extended by the period of time between the date of final acceptance by Owner and actual performance of the work. This obligation shall survive acceptance of the work and termination of the Contract.
1. Warranties shall be in the form outlined below and shall be submitted in duplicate to the Contractor and submitted on his own letterhead.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
1. DIVISION 00 SPECIFICATION SECTIONS.
  2. DIVISION 01 SPECIFICATION SECTIONS.
  3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SUBMITTALS

Warranty Form: (following page.)



(Contractor's Letterhead)

Project Number: \_\_\_\_\_

Project Name: \_\_\_\_\_

## WARRANTY FOR

\_\_\_\_\_  
We hereby warrant and the General Contractor warranties that  
\_\_\_\_\_  
\_\_\_\_\_

has been done in accordance with the Drawings and the Specifications and that the Work as installed will fulfill the requirements of the warranty included in the Project Manual. We agree to repair, replace any or all of our work together with any other adjacent work which may be displaced or damaged by so doing that may prove to be defective in its workmanship or materials within a period of \_\_\_\_\_ years from date of acceptance of the above-named without any expense to the Owner, ordinary wear and tear and unusual abuse or neglect excepted. In the event of our failure to comply with above-mentioned conditions within ten (10) days after being notified in writing by the Owner or his agent, we collectively or separately, do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense and we will honor and pay the costs and charges therefor upon demand.

\_\_\_\_\_  
(Signature of Subcontractor)

\_\_\_\_\_  
(Signature of Contractor)

Date: \_\_\_\_\_

- A. Submit 2 copies of all manufacturer's or installer/applicator's warranties and bonds as specified within Division 02 -49.
- B. Submit to Architect together with Project Record Documents.
- C. Accompany submittals with transmittal letter in duplicate.
- D. When Product Submittals are required, submit copy of warranty with product submittal.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION

## SECTION 01 78 39 – PROJECT DOCUMENTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes the administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Project As-Built Drawings.
  - 2. Project Record Drawings.
  - 3. Record Specifications.
  - 4. Record Product Data.
- B. Related Requirements: The following Project Manual Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.3 DEFINITIONS

- A. CONTRACT DOCUMENTS: Contract Documents include Contract Forms, Project Manual (Contract Requirements and Specifications), Drawings, Addenda, Change Orders and Modification Documents (Supplemental Instructions, Request for Information, Construction Change Directives).
- B. PROJECT "AS-BUILT" DOCUMENTS: A set of Contract Documents used during construction for recording of actual construction information during construction. The recording of construction information shall be maintained on the Contract Drawings and in the Project Manual.
- C. PROJECT "RECORD" DOCUMENTS: A set of Contract Documents used at the completion of construction for transferring and documenting the actual construction information recorded on the PROJECT "AS-BUILT" DOCUMENTS.
- D. RECORD PRODUCT DATA: A set of Submittals and Shop Drawings that have documentation of field changes made after review.
- E. AGENCY DOCUMENTATION: Documents required by the Agency Having Jurisdiction to be prepared and submitted by the contractor.

## 1.4 SUBMITTALS:

- A. Submit the following in accordance with specification Section SUBMITTAL PROCEDURES.
- B. Format for Submittals:
  - 1. Accompany each submittal with a SHOP DRAWING AND SUBMITTAL TRANSMITTAL:
  - 2. PDF electronic file names shall match the Sheet Numbers of the Contract Documents.
  - 3. Provide labels on DVD's and DVD Cases and include the following:
  - 4. First Line: CLOSE-OUT DOCUMENTS
  - 5. If submittal contains multiple disks append to first line Disk, i.e. (1 of 2)
  - 6. Second Line: Project Name and Year
  - 7. Third Line: Architect Firm Name and Architect's Project Number

8. Fourth Line: DSA or HCAI Number (if applicable)
  9. Fifth Line: Contractor Company Name
  10. PDF files for Project "Record" Documents and Record Product Data shall be combined with PROJECT CLOSEOUT, Maintenance Data and Operations Data, and WARRANTIES on a single set of DVD's.
- C. PROJECT "AS-BUILT" DOCUMENTS: Comply with the following:
1. Number of Copies: Submit one paper-copy set of marked-up as-built drawings and one paper-copy of marked-up as-built specifications.
  2. Clearly Label each copy "PROJECT 'AS BUILT' DOCUMENTS" in two-inch-high printed letters.
- D. PROJECT "RECORD" DOCUMENTS: Comply with the following:
1. Number of copies: Submit copies of the Record Documents as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy of marked-up record drawings and one paper copy of marked-up record specifications,
      - 2) Alternatively, submit PDF electronic files of scanned marked-up record drawings and marked-up record specifications on one set of DVD's
      - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    2. Final Submittal:
  3. Submit one paper-copy of marked-up record drawings, one paper copy of marked-up record specifications, and PDF electronic files of scanned marked-up record drawings and marked-up record specifications on three sets of DVD's.
  4. Each record drawing sheet shall be labeled, "PROJECT "RECORD" DOCUMENT. □
  5. Print each drawing, whether or not changes and additional information were recorded.
  6. Clearly Label each copy "PROJECT "RECORD" DOCUMENTS in two-inch-high printed letters in a prominent location.
- E. RECORD PRODUCT DATA: Comply with the following:
1. Number of Copies:
    - a. Submit one paper-copy set of marked-up shop drawings.
    - b. Submit three DVD's of PDF electronic files of scanned marked-up shop drawings.
- F. AGENCY DOCUMENTATION: Comply with the following:
1. Submit Documentation Required by the Agency Having Jurisdiction utilizing the format and system established by the Agency.
- 1.5 SYSTEM DESCRIPTION
- A. The Architect considers the Project Record Documents to be of significant importance to the Owner.
  - B. Project Record Documents provide important information for the Owner's records, they form an invaluable record for future reference for concealed conditions, facilities management processes, and future additions and renovations.

## PART 2 - PRODUCTS

- 2.1 General:
- A. All costs (including the time) required for recording, transferring, and copying all documentation shall be part of the Contractor's Overhead Expense.
  - B. Provide red pencil or ink (contrasting color) for all marking of the PROJECT "AS-BUILT DOCUMENTS, PROJECT "RECORD" DOCUMENTS, and RECORD PROJECT DATA.
  - C. Do not permanently conceal any work until required information has been recorded.

## 2.2 RECORD DRAWINGS

- A. PROJECT "AS-BUILT" DOCUMENTS: Maintain one set of marked-up paper copies of the Contract Drawings: and Specifications, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Elevation for finish grade for all points indicated on Site Grading Plan.
    - b. Depths of various elements of foundation in relation to first floor finish elevation.
    - c. Horizontal and vertical location of underground utilities and appurtenances referenced to visible and accessible features of structure.
    - d. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities Field changes of dimensions and details.
    - j. Changes made by Addenda, Change Orders and other Modification Documents.
    - k. Details not on original Contract Documents.
    - l. Changes made on Shop Drawings.
  3. Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
    - a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
    - b. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
    - c. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
    - d. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
    - e. Note related Changes Orders, record Product Data, and record Drawings where applicable.
  4. Mark the Contract Drawings and Specifications completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  5. Note Request for Information numbers, Supplemental Instruction numbers, Construction Change Directive numbers, Change Order numbers, and similar identification, where applicable.

## 2.3 PROJECT "RECORD" DOCUMENTS:

- A. General: Transfer all changes, notations, etc. from the "AS-BUILT" PROJECT DOCUMENTS to the "PROJECT RECORD" DOCUMENTS in the same quality as the original Contract Documents.

## 2.4 RECORD PRODUCT DATA

- A. Maintain one set of marked-up paper copies of the Shop Drawings and Product Data, incorporating any modifications to the reviewed documents.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders and record Drawings where applicable.
  - 4. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## 2.5 AGENCY DOCUMENTATION

- A. Contractor shall prepare and upload all applicable forms pertaining to the Contractor as required by the Division of State Architect DSA Procedure 13-02, including but not limited to:
  - 1. DSA 6-C - Contractor Verified Report.
  - 2. NFPA System Record of Completion.

# PART 3 - EXECUTION

## 3.1 RECORDING AND MAINTENANCE:

- A. Recording:
  - 1. Keep all documents current, PROJECT "AS-BUILT" DOCUMENTS shall be kept current at all times. Post changes and revisions to project as-built documents as they occur; do not wait until end of Project.
  - 2. The Project Inspector will review the PROJECT "AS-BUILT" DOCUMENTS periodically for the Architect at the time Payment Requests are processed. Should the PROJECT "AS-BUILT" DOCUMENTS not be current and up to date, the Owner reserves the right to hold the Payment Request until compliance with the Contract Documents has occurred.
- B. Maintenance of Documents:
  - 1. Maintain at job site the following:
    - a. Contract Drawings.
    - b. Project Manual/Specifications.
    - c. Addenda.
    - d. Reviewed shop drawings.
    - e. Change Orders.
    - f. All Modification Documents.
    - g. Field test records.
  - 2. Store documents in field office apart from documents used for construction.
  - 3. Provide files and racks for storage of documents.
  - 4. File documents in accordance with Project Filing Format or Uniform Construction Index.
  - 5. Maintain documents in clean, dry, legible condition.
  - 6. Do not use record documents for construction purposes.
  - 7. Make documents available at all times for inspection by Architect, Owner and Owner's Inspector.

END OF SECTION



## SECTION 02 41 19 - SELECTIVE DEMOLITION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This section includes the following:
  - 1. Section includes requirements governing execution of the work including, but not limited to, the following:
    - a. Demolition and removal of selected portions of building or structure.
    - b. Demolition and removal of selected site elements.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS
  - 2. DIVISION 01 SPECIFICATION SECTIONS
  - 3. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP
  - 4. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP

## 1.2 REFERENCES

- A. Standards:
- B. In accordance with the latest edition of the following standards:
  - 1. ANSI A10.6 American National Standards Institute

## 1.3 DEFINITIONS

- A. Remove: Detach items from existing site or building (s) and legally dispose or recycle off-site.
- B. Remove and Salvage to Owner: Carefully detach from existing site or building (s), in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing site or building (s), prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing item(s) within project site that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

## 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Shop Drawings:
    - a. Proposed Protection Measures - Submit report and drawings that indicates the measures proposed for protecting individuals and property for dust and noise control.
      - 1) Indicate proposed locations and construction of barriers.
      - 2) Indicate occupant paths of egress and travel.
      - 3) Indicate how long utility services will be interrupted.
    - b. Salvaged Item Inventory List
      - 1) Indicate items to be salvaged and delivered to Owner.
  - 2. Closeout Submittals:

- a. Existing Warranties
- b. Pre-demolition Photographs

## 1.5 QUALITY ASSURANCE

### A. Regulatory Requirements:

- 1. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
  - a. CAL/OSHA California Division of Occupational Safety and Health Administration.
  - b. CF County of Fresno, codes and ordinances
  - c. EPA Environmental Protection Agency

### B. Meetings:

- 1. Pre- Demolition: Schedule prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Review requirements of work performed by others that rely on substrates exposed by selective demolition work.
  - c. Identify any potential problems that may impede planned progress and proper demolition of work.
  - d. Review structural load limitations of existing structure.
  - e. Review areas where existing construction is to remain and requires protection.
  - f. Review demolition waste disposal and material recycling procedures.
- 2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper work progress.
  - b. Identify any problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
- 3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems.
  - b. Establish method and procedures to maintain protections while progressing to project completion.

## 1.6 DELIVERY, STORAGE, AND HANDLING

### A. Cleaning, handling, and packing:

- 1. Salvaged Items and Reinstalled Items shall be handled in such a manner as to assure that they are free from damage.
- 2. Salvaged Items shall be cleaned and packed or cleaned and palletted.
- 3. Reinstalled Items shall be cleaned.

### B. Storage and protection

- 1. Salvaged Items and Reinstalled Items shall be stored in a dry, protected area.
- 2. Salvaged Items and Reinstalled Items shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation underneath.
- 3. Cover with protective waterproof covering providing for adequate air circulation and ventilation.

### C. Waste Management and Disposal:

- 1. Disposal of all selective demolition items shall be per Specification Section - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.



## 1.7 PROJECT CONDITIONS

### A. Environmental requirements:

1. Dust control - perform site, exterior, and interior work in a manner as to minimize the spread of dust and flying particles.
  - a. Thoroughly moisten appropriate surfaces as required to prevent dust from being a nuisance to the occupants, public, and neighbors.
2. Noise control - perform work in a manner as to minimize construction noise.
  - a. When a certain level of noise is unavoidable and is objectionable to the occupants of the adjacent spaces, buildings, or premises, coordinate with Owner and make arrangements to perform such work at the most appropriate time periods of the day.

### B. Existing conditions:

1. Examine project site and building(s) and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent buildings, roads, streets, drives, and walks.
  - a. Do not close or obstruct streets, alleys, walks, or passageways without permission from authorities having jurisdiction and coordinating same with immediate neighbors whose business operation may be affected.
  - b. Safety measures shall be taken to insure an uninterrupted flow of traffic around the site as required by local Police and Fire Departments
3. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
4. Maintain existing utilities indicated to remain in service and protect against damage during selective demolition work.
  - a. Maintain fire-protection facilities in service during the work.
5. Demolition waste becomes the property of the Contractor.
6. Storage or sale of removed items on-site is not permitted.
7. It is not expected that hazardous materials will be encountered in the Work.
  - a. Hazardous materials will be removed by Owner before start of the Work.
  - b. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
8. Hazardous materials are present in buildings and structures to be selectively demolished. The Owner has prepared a report for the Contractor to review and use.
  - a. Hazardous material remediation is specified in Specification Section - HAZARDOUS MATERIAL PROCEDURES.

## 1.8 WARRANTY

### A. Existing Warranties:

1. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warranter before proceeding. Existing warranties include the following:
  - a. Roofing system
2. Notify warranter on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Furnish all materials, tools, equipment, facilities, and services as required for performing the selective demolition and removal work.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of conditions:
  - 1. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 2. Execution of work under this specification section shall constitute acceptance of existing conditions.
  - 3. Obtain all necessary permits and authorizations by regulatory agencies required to perform the Work under this Section.
  - 4. Verify that utilities have been disconnected and capped before starting selective demolition operations.
  - 5. Verify that rooftop utilities and service piping have been shut-off prior to roof selective demolition.
  - 6. Record existing conditions by use of Pre-demolition Photographs.
    - a. Inventory and record the condition of items to be salvaged and/or re-installed.

### 3.2 PREPARATION

- A. Coordination:
  - 1. Before proceeding, verify plans match existing conditions.
  - 2. Review documents of existing construction provided by Owner against existing conditions.
  - 3. If conflicts are encountered, report it to the Architect. Then prepare recommendation(s) for correction and submit to Architect for review.
  - 4. Coordinate work under this specification section with work specified under other sections.
  - 5. Coordinate any utility and HVAC unit shut-down with owner 48 hours in advance of the anticipated shut-down.
    - a. Do not interrupt utilities and HVAC units serving occupied or used facilities, except when authorized in writing by the Owner.
    - b. Provide temporary service during interruptions to existing facilities, as may be required by the Owner to maintain essential services.
  - 6. Prior to site selective demolition, review status of trees and shrubs with Architect and Owner. The Owner may wish to relocate trees or shrubs outside the limits of construction.
  - 7. Prior to roofing selective demolition, coordinate with Owner to shut down air intake equipment and service piping in the vicinity of work.
- B. Protection:

1. Structure and Property:
  - a. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings, landscape, and facilities to remain.
  - b. All damage inflicted on public and private property and the property of the Owner shall be repaired or restored to the original condition prior to the start of this Work. All repair or replacement work shall be done at no additional cost to the owner.
  - c. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building and site.
  - d. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and other weather damage to building envelope, structure, and interior areas.
  - e. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - f. Protect and maintain utility services and mechanical/electrical systems to remain.
  - g. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - h. Cover all air supply and return ducts to remain before proceeding with demolition work.
  - i. Cover air intake louvers before proceeding with work that will affect indoor air quality.
  - j. During roof selective demolition have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
2. Temporary Shoring:
  - a. Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
    - 1) Strengthen or add new supports when required during progress of selective demolition.

### 3.3 APPLICATION

#### A. General:

1. Selective demolition shall include the removal of all components of the existing building and/or site described in the documents to be removed. Unless otherwise specified, the component identified for removal shall include all materials, accessories and fabrications associated with that component.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
  - a. Temporarily cover opening to remain.
  - b. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. When removing structural framing members, lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
5. Locate selective demolition equipment and demolished debris so as not to impose excessive loads on supporting walls, floors, or framing.
6. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems.

7. Demolished items and materials that are recyclable or slated for disposal shall be promptly dealt with per Specification Section - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
  8. Removed and Salvaged items:
    - a. Clean salvaged items.
    - b. Pack or crate items after cleaning. Identify contents of containers.
    - c. Store items in a secure area until delivery to Owner.
    - d. Transport item to area as designated by Owner.
    - e. Protect items from damage during transport and storage.
    - f. In addition to items indicated elsewhere, salvaged items that the Owner wants to retain in usable condition are as follows:
      - 1) All door hardware
      - 2) All unit heater and controls
      - 3) All energy management controls
      - 4) All security system devices
  9. Removed and Reinstalled items:
    - a. Clean and repair items to functional condition adequate for intended reuse.
    - b. Pack or crate items after cleaning and repairing. Identify contents of containers.
    - c. Protect items from damage during transport and storage.
    - d. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
  10. Existing Items to Remain:
    - a. Protect construction indicated to remain against damage and soiling during selective demolition.
- B. Site Selective Demolition:
1. Utility lines to be abandoned within the construction area shall be removed and stubbed off outside the limits of construction.
  2. Maintain existing storm drainage system to remain in functioning condition. Prevent debris from entering or blocking drains and piping. Use drain plugs specifically for this purpose. Remove drain plugs at the end of each work day.
  3. Refer to drawings for trees and shrubs to be removed. Protect certain trees as indicated.
    - a. Remove tops, trunks, and roots of trees and shrubs to a minimum depth of 3 feet or to a depth required to remove all roots 1/4 inch diameter and larger.
    - b. Chip removed trees, shrubs, and roots.
      - 1) Removed chipped material to recycling station.
      - 2) Recycle chipped material into mulch for this project. Refer to Specification Section - LANDSCAPE PLANTING for treatment.
  4. Remove debris, concrete, asphalt, and any other obstruction to the extent indicated.
  5. Remove all:
    - a. Buried objects which will interfere with the Work.
    - b. Irrigation lines, irrigation risers, and irrigation valves.
    - c. Stand pipes.
    - d. Water wells and pumps.
    - e. Electrical service and power poles.
  6. At building pads, site improvements, or trenching, strip topsoil which contains:
    - a. Grass, weeds, and natural vegetation to a minimum depth of [12 inches.
    - b. Stumps and roots 1/4 inch and larger.

7. Remove non-soil materials from topsoil, including clay lumps, gravel, trash, debris, weeds, roots, other waste materials, and objects more than 1/2 inch in diameter.
  8. Stockpile reusable topsoil away from excavation and where work is to proceed.
    - a. Do not stockpile topsoil within drip line of remaining trees.
  9. Non-soil materials removed from topsoil shall be separated into like materials and recycled either within the project or removed from the project site to a recycling station.
    - a. Those waste materials that are non-recyclable shall be legally disposed off of the project site.
- C. Roofing Selective Demolition:
1. Maintain roof drains in functioning condition to ensure roof drainage at end of each work day. Prevent debris from entering or blocking roof drains and conductors. Use roof drain plugs specifically for this purpose. Remove roof drain plugs at end of each work day, when no work is taking place, or when rain is forecast.
  2. Remove existing roofing membrane and other roofing system membrane components down to the deck including flashings, copings, and roof accessories.
    - a. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove un-adhered bitumen and felts.

### 3.4 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT:
1. Clean any soiled surfaces to remain immediately.
  2. Existing substrates shall be clean and ready for the installation of any additional materials.
  3. Leave site areas level and free of any ruts or debris. Appearance of earth surface shall be equal to or better than adjacent undisturbed surfaces.

END OF SECTION

## SECTION 03 11 01 – CONCRETE FORMWORK

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Concrete Formwork materials, and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 15 14 DRILLED ANCHORS
  - 4. 03 20 00 REINFORCEMENT
  - 5. 03 30 00 CAST-IN-PLACE CONCRETE
  - 6. 03 35 10 POLISHED CONCRETE FINISHING
  - 7. 05 12 00 STEEL AND FABRICATIONS
  - 8. 07 40 00 METAL PANELS
  - 9. 07 92 00 SEALANTS
  - 10. 31 20 00 EARTHWORK
  - 11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 12. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the latest edition of the following standards:
    - a. ACI American Concrete Institute
    - b. APA The Engineered Wood Association (American Plywood Association)
    - c. PS Product Standards of the U.S. Department of Commerce, latest edition
    - d. WCLIB West Coast Lumber Inspection Bureau

## 1.3 DEFINITIONS

- A. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.
- B. Unexposed: concealed surface.
- C. Exposed: exposed surface.

## 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Forming materials.
    - b. Tie rods and spreaders.
    - c. Formwork for exposed concrete.
    - d. Form coatings and release agents.
  - 2. Shop Drawings:
    - a. The Contractor shall submit drawings showing the proposed form tie locations for exposed form indentations.
  - 3. Samples.
    - a. Form liners for specific finished concrete surfaces.

4. Quality Assurance/Control Submittals:
  - a. Manufacturer's written Instructions:
    - 1) Instructions for specific form liner manufacturer indicated.
5. Closeout Submittals:
  - a. Record Documents in accordance with Specification Section – PROJECT DOCUMENTS.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the Work.
- B. Regulatory Requirements:
  1. In accordance with Specification Section - REGULATORY REQUIREMENTS.
- C. Mockups:
  1. Cast in accordance with Specification Section – CAST-IN-PLACE CONCRETE, Part 1 Article titled "SUBMITTALS," paragraph titled "Mockups" for requirements.
    - a. Provide with all applicable joints, grooves, textures, etc.

## 1.6 WARRANTY

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period: One (1) Year.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES.
    - a. Warranty Period: One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

### 2.2 UNEXPOSED FINISH FORMS

- A. Provide plywood, lumber, or another acceptable material.
  1. Lumber shall be dressed on at least two edges and one side for tight fit, complying with WCLIB Standard Grading and Dressing Rules #17, for Douglas Fir Form Lumber.

2. When plywood is used, provide panels complying with PS1, B-B (Concrete Form) Plywood, Group 1, EXT-APA mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

### 2.3 EXPOSED FINISH FORMS

- A. Provide plywood panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown on the drawings.
  1. Single Pour Forms: Provide liner panels that are complying with PS1, MDO Plywood, B-B, Group 1, EXT-APA, mill-oiled, edge-sealed, with each piece bearing legible inspection trademark, which are limited to "single-pour use" forms, that are manufactured by SIMPSON TIMBER PRODUCTS, or approved equivalent.
  2. Multiple Pour Forms: Provide HDO Plywood "Multipour" liner panels, which are limited to "double-pour use" forms, that are manufactured by SIMPSON TIMBER PRODUCTS, or approved equivalent.

### 2.4 ACCESSORIES

- A. Cement Compound Plugs:
  1. Provide gray colored cement compound plugs ("SnaPlug" by MEADOW / BURKE, or approved equivalent) in highly visible concrete surface areas.
    - a. Provide "flush type" in cone holes of size appropriate to the hole size created by tie-holes.
  2. Provide a waterproof neoprene adhesive ("SnaPlug Bonder" by MEADOW / BURKE, or approved equivalent), resistant to weather aging and bacterial growth, for adhering cement compound plugs into cone holes.
- B. Chamfer Strips:
  1. Provide wood chamfer strips free of knots, for forming edges of cast-in-place concrete.
- C. Double Sided Foam Tape: Provide "Scotch" double sided, high density, pressure sensitive adhesive, foam tape as manufactured by The Tape Division of 3M PRODUCTS, INC., or approved equivalent.
- D. Form release agent:
  1. Provide commercial formulation form release agent with a maximum volatile organic compounds (VOC's) in compliance with the CARB in the area where the project is located, that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  2. Provide form liner manufacturer's form release agent when a particular form liner is used to maintain compatibility with form release agent and the form liners used for this project.
- E. Rustication Strips:
  1. Provide wood rustication strips free of knots, for forming straight continuous reveals (either vertically or horizontally) and PVC rustication strips as manufactured by MEADOW / BURKE, for forming curved continuous reveals (either vertically or horizontally).
- F. Spreaders and ties for loose plywood forming:
  1. Spreader Ties: Use metal spreaders and ties for surfaces to be sacked. Use type that will give positive tying and accurate spreading for accurate sizing of cast walls or forms. Snap type shall leave no metal closer than 1-1/2 inches from exposed surface of concrete and have spreader cones no larger than 1 inch diameter. MEADOW / BURKE COMPANY.
- G. Nailer Strip:
  1. Provide decay resistant pressure treated wood nailer strips of sizes and locations indicated on the drawings.



- a. For roof systems, provide compatible materials with the roof system manufacturer's applications.
- b. Provide fire retardant pressure treated wood nailer strips when the roof assembly requires a Class A rating.
2. All pressure treated wood (decay or fire-retardant) shall be in accordance with the applicable standards of the AWWPA as referenced in the Specification Section - ROUGH CARPENTRY.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Surface preparation:
  1. Consult with other Trades relative to required openings, and items to be embedded in concrete (i.e., piping, conduit, hangers, reglets, anchors, inserts, sleeves, etc.). Coordinate work specified under other sections to ensure proper, adequate interfacing between trades, for openings, chases, blockouts, and other required interfacing items.

### 3.2 ERECTION

- A. All formwork shall be:
  1. Designed and constructed in accordance with ACI Standard 347 "Recommended Practice for Concrete Formwork."
    - a. Follow ACI 303R "Guide to Cast-In-Place Architectural Concrete" for further recommendations in design and use of Patterned Form Liners.
  2. Construct to size, shape, alignment, elevation and position of all concrete elements.
    - a. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in the work. Use selected materials to obtain required finishes.
    - b. Orient circular fiberglass forms so that the seam is always facing the nearest adjacent wall, or an obscure side not highly visible. Contact the Architect for conditions not easily determined.
  3. Properly separate and securely tie with Spreaders and Ties to maintain proper shape. Wood spreaders shall not be allowed to remain in concrete work.
    - a. Use "Penta-Ties" where indicated on the drawings. Glue in cement compound plugs.
  4. Brace, support and center sufficiently to carry without excessive deflection all live and dead loads imposed during construction and placement of concrete, and to insure safety to workers and passersby.
    - a. Block adjoining permanent pan units left in place to prevent lateral deflection of forms while placing concrete.
  5. Properly construct to eliminate all open joints or discontinuous surfaces.
    - a. Solidly butt joints with double sided foam tape, apply silicone sealant at concrete face, and provide backup at joints to prevent cement paste or mortar from leaking.
- B. All joints shall be:
  1. Uniform and backed by 2 inch material.
  2. Continuous and level or plumb.
  3. Sufficiently tight (with double sided foam tape and silicone sealant) to prevent leakage of cement paste.
    - a. Locate joints of formwork whenever possible at rustication joints.
  4. Subject to Architect's approval.

### 3.3 INSTALLATION

- A. General: Design, engineer, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
1. Access Openings: Shall be provided in forms for cleaning and inspection of forms and reinforcement.
    - a. In Wall Forms: Provide openings for each pour, composed of a form section held out until inside of each formed cavity has been cleaned, so that no "access hole" is visible in the finished concrete surface.
  2. Architectural Concrete elements shall be formed with MDO (or HDO) form plywood where face uniformity is required such as on signs, plaques, kiosks, and landscape elements.
  3. Side forms at unexposed footings may be omitted if excavation stands without caving.
    - a. Make footing trench two (2) inches wider than width of concrete footing indicated on the drawings, when earth is used as a form.
    - b. Cut trenches true and straight.
    - c. Make side cuts neat and plumb.
    - d. Bottom of trenches shall be level with reasonably sharp corners.
  4. Formwork above grade (stairs, curbs, exposed faces of concrete foundations, etc.) shall be:
    - a. Plywood type as specified treated with Sealer.
    - b. Constructed with plumb and level joints.
    - c. Separated with removable or snap type Spreaders and Ties. Do not use wire ties.
  5. Unintentional indentations in the surface of the concrete left after removal of spreaders and ties shall be filled and sacked unless the architect's approval is given to do otherwise.
    - a. Install Cement Compound Plugs where exposed form tie indentations occur.
  6. Sleeves, anchors and bolts, angles, supports, ties and other materials in connection with concrete construction shall be secured in position before the concrete is placed.

### 3.4 CONSTRUCTION

- A. Special Techniques – Form Removal and Reuse of Forms:
1. All forms shall be completely removed.
  2. Time of Removal shall be in accordance with ACI 301 "Specifications for Structural Concrete," which requires concrete to reach its specified compressive strength. Variations to the time of removal are listed below subject to the concrete reaching its specified compressive strength:
    - a. Dependent on weather conditions.
      - 1) Due to excessive cold weather for a long duration of days, and subject to the Architect's approval, the time for removal may be extended if deemed necessary.
    - b. Dependent on cylinder test results.
    - c. Dependent on recommendations of additive manufacturer when additives are admitted to the mix.
    - d. Typically (verify with three statements above before initiating the following):
      - 1) Foundation Side Forms: Five (5) days after concrete is poured.
      - 2) Wall Forms: Ten (10) day after concrete is poured.
      - 3) Beam, Slab and Joist Soffit Forms:
        - a) Twenty-One (21) days after concrete is poured.
        - b) Re-shore as required to support dead loads and any construction loads applied.

- e. Remove forms in a manner that will not harm concrete. Do not hammer or pry against concrete.
- 3. Nails, tie wires and form ties shall be cut off flush with face of concrete.
- 4. Snap type spreaders to be snapped off inside the wall surface.
- 5. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release compound as specified for new formwork.
- 6. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to the Architect.
- B. Site Tolerances:
  - 1. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 "Guide to Formwork for Concrete" limits:
    - a. Provide Class A tolerances (permitted irregularities are 1/8" in 10' for both gradual and abrupt) for all concrete surfaces exposed to view, or surfaces that will receive additional applied finishes.
  - 2. Concrete work out of alignment, or level or plumb exceeding the allowable tolerance will be cause for rejection of the whole work affected. Such work shall be removed and replaced as directed by Architect with no additional cost to Owner.

### 3.5 CLEANING

- A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Re tighten forms and bracing before placing concrete, as required, to prevent leakage of cement paste and maintain alignment.
- B. Remove all wood used for formwork from trenches. No wood shall be left buried in the earth.
- C. Final cleaning shall be in accordance with Specification Section – PROJECT CLOSEOUT.

END OF SECTION

SECTION 03 15 14 – DRILLED ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all Drilled Anchor materials, labor, equipment and services necessary for Expansion, Adhesive, and Screw Anchors in Concrete, and Concrete Masonry Units, and related items necessary to complete the Project as indicated by the Contract Documents unless otherwise specifically excluded.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 20 00 REINFORCEMENT
  - 5. 03 30 00 CAST-IN-PLACE CONCRETE
  - 6. 05 12 00 STEEL AND FABRICATIONS
  - 7. 06 41 23 MODULAR CASEWORK
  - 8. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 9. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Submit manufacturer's product data for all expansion and adhesive anchors to be used in this project.
      - 1) Submit current ICC Evaluation Services research or evaluation reports evidencing maximum allowable shear and withdrawal load data.
  - 2. Quality Assurance / Control Submittals:
    - a. Test Reports: Submit to DSA, copy to Project Inspector and Contractor.
      - 1) Tension Testing as required.

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility:
  - 1. To ensure consistent quality of anchorage, obtain drilled anchors from a single manufacturer.
  - 2. To ensure consistency of anchorage, obtain adhesive for anchorage from a single manufacturer.
- B. Manufacturer Qualifications: Provide drilled and adhesive anchors from a manufacturer that can demonstrate ICC approvals that are current and acceptable to review by the DSA/SSS.
- C. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
  - 1. ICC International Code Council.
  - 2. IR Interpretation of Regulations.
- D. Job Testing: For verifying satisfactory installation workmanship, an independent laboratory will perform proof load tests of drilled anchors acting in tension or shear in the presence of the Project Inspector.
  - 1. When drilled-in expansion-type anchors or other post-installed anchors acceptable to the enforcement agency are used in lieu of cast-in-place bolts, the allowable shear and

tension values and installation verification test loads shall be acceptable to the enforcement agency.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in original, unopened packages with manufacturer's labels identifying products legible and intact.
- B. Store materials inside, under cover and in a manner to keep them dry, protected from the weather, surface contamination, corrosion, damage from construction traffic and other causes.

**1.5 WARRANTY**

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period: One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES.
    - a. Warranty Period: One (1) Year.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

**2.2 MATERIALS**

- A. Provide manufacturers standard drilled anchors (expansion or adhesive) for installation into Concrete or Concrete Masonry Units unless noted otherwise.
  - 1. Metal Finishes (corrosion resistant):
    - a. Zinc Plated Carbon Steel.
    - b. Stainless Steel.

**2.3 EXPANSION ANCHORS:**

- A. Specified product manufacturer: HILTI INC.
  - 1. Acceptable alternative manufacturer, subject to compliance with requirements:
    - a. DEWALT/POWERS.
    - b. SIMPSON.
- B. Wedge Anchors: The WEDGE category features a small split expansion ring installed on a tapered (integral cone) part of the stud at the bottom. As the nut is tightened, withdrawing the stud portion from the hole, the expansion ring engages the concrete and is further expanded on the tapered part of the stud.
- C. Sleeve Anchors: The SLEEVE category is similar to the wedge except a large expansion sleeve is used instead of a small expansion ring. The outside of the sleeve defines the anchor diameter with the threaded stud being of a smaller diameter since it fits inside the sleeve. The stud has an

integral cone expander at the bottom similar to the wedge category. The expansion mechanism is similar to the wedge category except the top of the sleeve is normally in contact with the nut/washer and is initially forced down over the cone expander as the anchor is tightened. As the sleeve is expanded, it engages the concrete and continues to expand as the wedge anchor.

- D. Shell Anchors: The SHELL category has the most variations, but all use a tapered cone expander, either internal or external, to expand the shell of the anchor against the hole. The anchor is either hammered down over an external expander or a special tool is used to drive an internal expander further into the anchor.

## 2.4 ADHESIVE ANCHORS

- A. Specified product manufacturer: HILTI INC.
  - 1. Acceptable alternative manufacturer, subject to compliance with requirements:
    - a. DEWALT/POWERS.
    - b. SIMPSON.
- B. Adhesive Anchors which chemically bonds Steel Rods or Deformed Steel Reinforcement Dowels to concrete or masonry elements:
  - 1. Threaded Steel Rods with minimum yield strength of 36 ksi and complying with ASTM A36 "Specification for Carbon Structural Steel," or ASTM A193 "Specification for Alloy-Steel and Stainless Steel Building Materials for High Temperature or High Pressure Service and Other Special Purpose Applications," Grade B7.
  - 2. Deformed Steel Reinforcement Dowels shall be a minimum of Grade 60 and comply with ASTM A615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement" or ASTM A706 "Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement."
  - 3. Adhesives, consisting of two primary components that are stored separately, and having a mixing nozzle provided by the manufacturer combining the components prior to placing in the holes.
  - 4. Long term durability and stability of the adhesive anchor material and its resistance to loss of strength and chemical change at elevated temperatures shall be established to the satisfaction of the enforcement agency.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordination:
  - 1. Coordinate and provide anchors and installation instructions from the manufacturer for items to be embedded in Concrete or Concrete Masonry Unit construction. Manufacturer's written installation instructions shall be available on the project site.

### 3.2 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices where necessary for securing designated items indicated on the drawings, or as necessary for a complete and proper job to in-place construction.
  - 1. Install the anchors in accordance with the requirements given in the ICC Evaluations Services Report recommendations for the specific anchor used.
  - 2. When installing expansion anchors through metal deck into concrete, the anchors should be installed in the center of the low flute of the decking where practicable in minimum 20 gage deck.
    - a. The minimum depth of embedment shall be 1-1/2 inches above the top flute of the decking (except 1/4 and 5/16-inch diameter anchors for ceilings) when the slab thickness above the top of the flute is at least 3 inches.

- b. Shell type anchors shall not be used on the underside of concrete and metal deck construction due to damage caused to the concrete when hammering in the shell anchors.
  - 3. Install Adhesive Anchors by placing adhesive into specially prepared holes, then insert rods or dowels into holes in a manner that disperses the adhesive to assure maximum contact between adhesive, surface of the holes and surface of the anchor.
    - a. Adhesive anchors shall not be used in overhead applications.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling and fitting required for designated items of construction. Set work accurately in location, alignment and elevation, level true and free of rack, measured from established lines and levels.
  - 1. The minimum edge distance and spacing of wedge and adhesive anchors shall not be less than ten (10) diameters or as required by ICC Evaluation Service Report unless specifically shown on drawings.
- C. Use care and caution to avoid cutting or damaging reinforcing bars in Reinforced Concrete or Concrete Masonry Construction.
- D. Do not install expansion or adhesive anchors in recently placed concrete which has not had a minimum 28 day curing period and which has not been accepted as having a minimum compressive strength of 3000 psi.

### 3.3 FIELD QUALITY CONTROL

- A. Testing, General:
  - 1. Perform testing in accordance with ACI 318 "Building code Requirements for Structural Concrete and Commentary," and herein specified.
    - a. When expansion or adhesive anchors are listed for sill plate bolting applications, 10 percent of the anchors shall be tested.
    - b. When expansion or adhesive anchors are used for other structural applications, all such anchors shall be tested.
      - 1) Expansion-type anchors shall not be used as hold-down bolts.
    - c. When expansion or adhesive anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group shall be tested, except that if the design load is less than 75 pounds, only one anchor in ten need be tested. See drawings for items weighing 75 pounds or less.
      - 1) The testing of the anchors shall be done in the presence of the Project Inspector and a report of the test results shall be submitted to the enforcement agency.
  - 2. When expansion anchors are used for ceiling hanger wires, 1 out of 10 must be field tested for 200 pounds of tension per IR 25-2.
    - a. When expansion anchors are used for ceiling bracing wires, 1 out of 2 must be field tested for 440 pounds in tension.
    - b. Test ceiling anchors with wires attached.
  - 3. The proof load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, calibrated spring-loading devices, etc.
  - 4. If any anchor fails testing, test all anchors of the same category not previously tested until twenty (20) consecutive pass, then resume the initial testing frequency.
    - a. The cost of any additional testing as a result of failures shall be the responsibility of the Contractor at no additional cost to the Owner.
  - 5. When a drilled-in adhesive anchor is used in lieu of a required cast-in-place bolt, cost of testing shall be the responsibility of the Contractor at no additional cost to the Owner.
- B. Testing:
  - 1. Expansion Anchors:

- a. Anchor diameter refers to the thread size for the WEDGE & SHELL categories, and to the anchor outside diameter for the SLEEVE category and Adhesive anchors.
  - b. Apply proof test loads to WEDGE & SLEEVE anchors without removing the nut if possible. If not, remove nut & install a threaded coupler to the same tightness of the original nut using a torque wrench & apply load.
  - c. For SLEEVE/SHELL internally threaded categories, verify that the anchor is not prevented from withdrawing by a baseplate or other fixtures. If restraint is found, loosen and shim or remove fixture(s) prior to testing.
  - d. Reaction loads from test fixtures may be applied close to the anchor being tested, provided the anchor is not restrained from withdrawing by the fixture(s).
  - e. SHELL type anchors shall be tested as follows:
    - 1) Visually inspect 25 percent for full expansion as evidenced by the location of the expansion plug in the anchor body.
      - a) Plug location of a fully expanded anchor shall be as recommended by the manufacturer, or, in the absence of such compensation, as determined on the job site following the manufacturer's written installation instructions.
      - b) At least 5 percent of the anchors shall be proof loaded as indicated in the Test Values schedule on the drawings, but not less than three anchors per day for each different person or crew installing anchors.  
or;
      - c) Test installed anchors per ACI 318 "Building code Requirements for Structural Concrete and Commentary."
2. Adhesive Anchors:
- a. Adhesive anchors shall be tension tested. The tension test load shall equal one and one-quarter ( $1\frac{1}{4}$ ) times the maximum design strength of the anchor as determined in compliance with ACI 318 Chapter 17 and the anchors evaluation report, or 80 percent of the yield strength of the bolt ( $0.8A_bF_y$ ), whichever is less.
    - 1) The test procedure for expansion-type anchors in the test values table shall also be used for the adhesive anchors.
  - b. Where adhesive anchors are used as shear dowels across cold joints in slabs-on-grade and the slab is not part of the structural system, testing of those dowels is not required.
  - c. Anchors shall exhibit no discernible movement during the tension test.
3. Test equipment (including torque wrenches) is to be calibrated by an approved testing laboratory in accordance with standard recognized procedures.
- a. Alternate torque test procedures and test values for SHELL type anchors may be submitted to the enforcement agency for review and approval on a case-by-case basis when test procedures are submitted and approved by the enforcement agency.
4. The following criteria apply for the acceptance of installed anchors:
- a. HYDRAULIC RAM METHOD: The anchor should have no observable movement at the applicable test load[. For wedge and sleeve type anchors, a practical way to determine observable movement is that the washer under the nut becomes loose].
  - b. TORQUE WRENCH METHOD: The applicable test torque must be reached within the following limits:
    - 1) Wedge or Sleeve Type: One-half ( $1/2$ ) turn of the nut.
      - a) One-quarter ( $1/4$ ) turn of the nut for the  $3/8$  inch sleeve anchor only.
    - 2) Torque testing of adhesive anchors is not permitted.
5. If the manufacturer's recommended installation torque is less than the test torque note in the table, the manufacturer's recommended installation torque shall be used in lieu of the tabulated values.



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6. Testing should occur 24 hours minimum after installation of the subject anchors.
7. Required Maximum Test Values for Concrete, or Concrete Masonry Units in tension for the ranges and sizes of Drilled Anchors are shown on the drawings.

END OF SECTION

## SECTION 03 20 00 – REINFORCEMENT

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all reinforcement material, labor, equipment and services necessary to completely install all reinforcing materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 15 14 DRILLED ANCHORS
  - 5. 03 30 00 CAST-IN-PLACE CONCRETE
  - 6. 05 12 00 STEEL AND FABRICATIONS
  - 7. 31 20 00 EARTHWORK
  - 8. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 9. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

- A. The following References and Manufacturer's Standards shall apply to this Specification Section:
  - 1. ACI American Concrete Institute
  - 2. ASTM American Society for Testing and Materials
  - 3. AWS American Welding Society
  - 4. CRSI Concrete Reinforcing Steel Institute

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data:
    - a. Manufacturer's specification and installation instructions for splice devices.
      - 1) Bar supports.
  - 2. Shop Drawings
    - a. Detail in accordance with ACI 315 "Details and Detailing of Concrete Reinforcing."
    - b. Indicate bending diagrams, assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies. Correctness of all reinforcing requirements and work is the responsibility of Contractor. Identify such shop drawings with reference thereon to sheet and detail numbers from Contract Drawings.
      - 1) Do not use scaled dimensions from Contract Drawings in determining the lengths of reinforcing bars.
      - 2) No reinforcing steel shall be fabricated without approved shop drawings.
      - 3) One of the required submittal copies shall be reproducible transparency.
      - 4) Any deviations from the contract documents must be clearly indicated as a deviation on the shop drawings.
      - 5) Areas of high congestion, including member joints and embed locations shall be fully detailed to verify clearances and assembly parameters and coordination with other trades.

- c. Certificates of Compliance with specified standards:
  - 1) Reinforcing Bars.
  - 2) Welded wire fabric.
  - 3) Welding electrodes.
- 3. Samples
  - a. Only as requested by Architect.
- 4. Quality Assurance/Control Submittals:
  - a. Test Reports - Testing Laboratory shall submit to DSA/SSS, Project Inspector, Architect, Structural Engineer and the Contractor one (1) copy of each report showing results of test.
    - 1) Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Structural Concrete."
    - 2) Testing Laboratory reinforcement tests in accordance with CBC Table 1705A.2.1, CBC Section 1910A, and the provisions of Specification Section - TESTING LABORATORY SERVICES.
    - 3) Owner will pay for tests of samples taken from identified bundles accompanied by mill analysis.
  - b. Certificates of Compliance with specified standards:
    - 1) Reinforcing bars.
    - 2) Welded wire fabric.
    - 3) Welding electrodes.
    - 4) Welder's Certification.
- 5. Closeout Submittals:
  - a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
  - b. Warranty.

#### 1.4 QUALITY ASSURANCE

##### A. Qualifications:

- 1. Installer Qualifications:
  - a. Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.
- 2. Welding Qualifications:
  - a. Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 - "Structural Welding Code Reinforcing Steel."
  - b. Welders shall be recently qualified by Test as prescribed in AWS "Standard Qualifications Procedure."
    - 1) Welders whose work fails to pass inspection shall be re-qualified before performing further welding.
- 3. Manufacturer/Supplier Qualifications:
  - a. Acceptable Manufacturers/Suppliers shall be regularly engaged in the manufacture of steel bar and wire fabric reinforcing.
- 4. Testing Laboratory will be approved by DSA/SSS, and selected by the Architect and the Owner.

##### B. Regulatory Requirements:

1. In accordance with Specification Section – REGULATORY REQUIREMENTS.
2. General:
  - a. Reinforcement work shall conform to ACI 301 "Specifications for Structural Concrete for Buildings," and CBC Section 1905A as minimum standards.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Packing, shipping, handling, and unloading:
  1. Deliver reinforcement to Project plainly tagged, completely fabricated and ready to set.
- B. Storage and protection:
  1. Store reinforcement above the ground surface on platforms, skids or other supports, protected from dirt, rust, or other substances which will prevent bonding to the concrete.
  2. Use all necessary care to maintain identification after bundles are taken apart.

**1.6 WARRANTY**

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period: One (1) Year.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES.
    - a. Warranty Period: One (1) Year.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Deformed Bars: In accordance with ASTM A 706 "Low Alloy Steel Deformed Bars for Concrete Reinforcement" and ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement," Grade as indicated on the structural drawings.
- B. Tie Wire: In accordance with ASTM A 82 "Cold Drawn Wire for Concrete Reinforcement," plain, cold-drawn steel.
- C. Welded Wire Fabric: In accordance with ASTM A 1064 "Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete."
- D. Steel Dowels: Same grade as bars to which dowels are connected.

**2.2 ACCESSORIES**

- A. Supports for Reinforcement: Provide bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening, deformed bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
  1. Supports and spacing of spacers per standards set forth by CRSI/WCRSI Manual of Standard Practice.
  2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are protected by plastic [color to match adjacent concrete surfaces] in accordance with CRSI Class I, or stainless steel in accordance with CRSI, Class II.
- B. Welding Electrodes: As per AWS D1.4 "Structural Welding Code for Reinforcing Steel."

- C. Mechanical Couplers: Mechanical Couplers shall develop 125 percent of the specified yield strength of the bars, and shall comply with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Section 12.14.3.

## 2.3 FABRICATION

- A. Bending: In accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," except as modified by CBC Sections 1905A.
  - 1. Fabricate reinforcement in accordance with the requirements of ACI 315 "Details and Detailing of Concrete Reinforcement," where specific details are not shown.
  - 2. Inside diameter of bends for stirrups and ties shall not be less than 1-1/2 inches for No. 3 bars, 2 inches for No. 4 bars and 2-1/2 inches for No. 5 bars.
  - 3. Where bent bars are straightened: field bending of bars will only be done in accordance with DSA/SSS approval per ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Section 7.3.2. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the drawings shall not be used. Heating of bars will not be permitted.
  - 4. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.
- B. Allowable Tolerances:
  - 1. Fabrication:
    - a. Sheared length: 1 inch.
    - b. Depth of truss bars: Plus 0, minus 1/2 inch.
    - c. Ties: Plus or minus 1/2 inch.
    - d. All other bends: Plus or minus 1 inch.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Placing:
  - 1. Place Reinforcement accurately.
  - 2. Do not move bars beyond allowable without concurrence of the Architect.
  - 3. Do not heat, bend, or cut bars without concurrence of the Architect.
  - 4. Reinforcement shall not be bent after being embedded in hardened concrete.
  - 5. Tie Reinforcement together at all intersections with Tie Wire.
  - 6. Support Reinforcing Bars by bar supports. Place and secure in accordance with CRSI "Specifications for Placing Bar Supports."
  - 7. Placement and support shall be complete.
  - 8. Do not use Reinforcing Bars with kinks or bends except when detailed on the structural drawings.
  - 9. Architect shall approve placement and support before concrete is deposited.
- B. Spacing:
  - 1. Clear space between parallel Reinforcing Bars shall not be less than 1 bar diameter nor less than 1 inch, unless otherwise noted on drawings.
- C. Splicing:
  - 1. At splices, lap Reinforcing Bars 53 diameters minimum, unless otherwise indicated on Drawings.
    - a. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
    - b. Splice Devices: Install in accordance with manufacturer's written instructions.
      - 1) Obtain the Architect's review before using.
    - c. Do not splice bars except at locations shown without the concurrence of the Architect.

- 1) Where splices in addition to those indicated are required, indicate location on shop drawings clearly and highlight "for the Architect's approval."
  2. Stagger splices as indicated on drawings. Splice locations shall be as shown on drawings or shall be approved by Architect and DSA/SSS.
    - a. Near floors.
    - b. Ductile concrete columns must splice at the centerline of the column height.
    - c. As detailed on the drawings.
  3. Where vertical Reinforcing Bars are offset at a splice, the slope of the inclined portion of bar with the axis of the column or wall shall not exceed 1 in 6.
  4. Welded Wire Fabric:
    - a. Install in long lengths, lapping 24 inches at end splices and one mesh at side splices.
    - b. Offset laps in adjacent widths.
    - c. Place fabric in approximately the middle of the slab thickness unless otherwise shown on the drawings.
    - d. Wire tie lap joints at 12 inch centers.
    - e. Use concrete blocks to support mesh in proper position.
  5. Mechanical bar splices shall be approved by the Architect and DSA/SSS.
- D. Welding:
1. Welding is not permitted unless specifically detailed on Drawings or approved by the Architect.
  2. Weld under supervision of qualified Testing Laboratory selected by Owner. Cost of supervision to be paid by the Owner. Weld only ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement," unless otherwise noted.
  3. Employ shielding metal-arc method and meet requirements of AWS D1.4 "Structural Welding Code for Reinforcing Steel."
  4. Welding is not permitted on bars where carbon equivalent is unknown or is determined to exceed 0.55.
  5. Welding shall not be done within two bar diameters of any bent portion of a bar which has been bent cold.
  6. Welding of crossing bars is not permitted.
  7. Provide material properties supplemental report for bars other than ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement."
  8. Weld in accordance with AWS D1.4 "Structural Welding Code for Reinforcing Steel."
    - a. Weld only where indicated on the drawings.
    - b. Weld only ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement," unless otherwise approved by the Architect and DSA/SSS.
  9. Inspection provided per CBC Table 1705A.3.
- E. Allowable Tolerances:
1. Placement:
    - a. Concrete cover to form surfaces: Plus or minus 1/4 inch.
    - b. Minimum spacing between bars: Plus or minus 1/4 inch.
    - c. Crosswise of members: Spaced evenly with 2 inches of stated separation.
    - d. Lengthwise of members: Plus or minus 2 inches.
  2. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.
- F. Drawing Notes: Refer to notes on drawings for additional reinforcement requirements.
- G. Mechanical, Electrical and Plumbing Drawings:

1. Refer to Mechanical, Electrical and Plumbing drawings for formed concrete requiring reinforcing steel.
2. All such steel shall be included under the work of this section.

### 3.2 CONSTRUCTION

#### A. Corrective Measures:

1. Notify Architect if conduit, piping, inserts, sleeves, etc. interfere with placement of Concrete Reinforcement as indicated on Drawings. Notify Architect immediately if any Concrete Reinforcement is found to be misplaced after concrete has been poured.
2. Do not cut, bend, kink or hickey misplaced reinforcement.
3. Make corrections only as directed by Architect and approved by DSA/SSS.
4. This Contractor shall bear the cost of any alteration, corrections or replacements of Concrete Reinforcing to concrete required because of misplaced reinforcement.

### 3.3 FIELD AND QUALITY CONTROL

#### A. Site Tests:

1. When inspections are indicated for reinforcement placement on the Structural drawings, a special inspector shall be employed to inspect reinforcing placement per CBC Table 1705A.3.
2. Inspect shop and field welding in accordance with AWS D1.4 "Structural Welding Code for Reinforcing Steel," including checking materials, equipment, procedure and welder qualifications as well as the welds. Inspector will use non-destructive testing or any other aid to visual inspection that he deems necessary to assure himself of the adequacy of the weld.

#### B. Inspections:

1. All reinforcing steel whose properties are not identifiable by mill test reports shall be tested in accordance with ASTM A 706 "Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement." One series of tests shall be performed for each missing report. Contractor shall pay for test required due to lack of positive identification, by means of a back charge by the Owner.
2. When tests are indicated for reinforcing steel on the structural drawings, the reinforcing steel used shall be tested in accordance with ASTM A 615 "Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement." One tensile and one bend test for each 2-1/2 tons of steel or fraction thereof, shall be made.

#### C. Tests and Inspection shall be performed by Owner's Testing Laboratory except when needed to justify rejected work, in which case the cost of re-tests and re-inspection shall be borne by the Contractor.

### 3.4 CLEANING

- #### A.
- Reinforcement, at time concrete is placed, shall be free of loose rust scale, mud, oil or other coating that will destroy or reduce the bond.

END OF SECTION

## SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. This Section includes the following:

1. Provide all material, labor, equipment and services necessary to completely install all Cast-In-Place Concrete materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
  - a. Footings.
  - b. Foundation Walls.
  - c. Slab on Grade.
  - d. Site Improvements.

## B. Related Sections: The following Sections contain requirements that relate to this Section:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 11 01 CONCRETE FORMWORK
4. 03 15 14 DRILLED ANCHORS
5. 03 20 00 REINFORCEMENT
6. 03 35 00 POLISHED CONCRETE FINISHING
7. 05 12 00 STEEL AND FABRICATIONS
8. 07 18 50 VAPOR-ALKALINITY CONTROL
9. 07 40 00 METAL PANELS
10. 07 92 00 SEALANTS
11. 08 41 00 STOREFRONTS
12. 09 30 00 TILE
13. 09 65 10 RESILIENT BASE AND ACCESSORIES
14. 09 68 40 CARPET
15. 10 05 00 MISCELLANEOUS SPECIALTIES
16. 10 14 00 IDENTIFYING DEVICES
17. 10 14 53 ROAD AND PARKING SIGNAGE
18. 10 21 13 TOILET PARTITIONS
19. 10 51 13 PLASTIC LAMINATE LOCKERS
20. 11 66 43 SCOREBOARDS
21. 31 20 00 EARTHWORK
22. 31 31 00 SOIL TREATMENT
23. 32 31 13 CHAIN LINK FENCING
24. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
25. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

## A. Standards:

1. In accordance with the following standards:
  - a. ACI American Concrete Institute
  - b. ASTM American Society of Testing Materials.
  - c. RFCI The Resilient Floor Covering Institute
  - d. RIS Redwood Inspection Service
  - e. RMAI Rubber Manufacturers Association Inc.

## 1.3 SYSTEM DESCRIPTION

## A. Design Requirements:



1. Make ready all interior concrete substrates to receive flooring:
  - a. Ensure the proper levelness and flatness of all concrete substrates for the intended flooring products.
    - 1) If leveling materials are required because of inadequate leveling during the pour and curing periods, follow all manufacturers written instructions for the proper preparation and application of these products.
    - 2) Verify that the concrete substrates are at the right RH (Relative Humidity) and Alkalinity Levels for the leveling materials in accordance with manufacturers written instructions.
  - b. Keep finished concrete substrates clean and ready for scheduled flooring applications during the construction process.
    - 1) Protect those substrates from excessive moisture build-up, and keep free of moisture puddles.
    - 2) Ensure that construction equipment does not leak fluids on substrates that would prevent bonding of flooring adhesives at the proper time for flooring installations.
  - c. Provide concrete substrates that are within acceptable limits of RH and that the Alkalinity of the concrete substrates are within the acceptable levels for adhesively applied flooring at the scheduled time for flooring installations.

#### 1.4 SUBMITTALS

##### A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Coordination Drawings:
  - a. Layout drawings for construction, control and expansion joints.
    - 1) Coordinate joints with floor patterns.
2. Product Data.
  - a. Submit data on all products listed under MATERIALS, and ACCESSORIES within this specification section.
3. Quality Assurance/Control Submittals:
  - a. Coordinate with Specification Section - TESTING LABORATORY SERVICES for additional Testing Requirements as required by DSA.
  - b. Material samples and mix designs:
    - 1) Material samples and mix designs as required for testing shall be submitted to Architect at least fourteen (14) days prior to any concrete work and shall include results of test data used to establish proportions.
      - a) Grout samples and colors for colored surfaces upon Architect's request only.
  - c. Continuous batch plant inspection required per CBC Section 1705A.3.3, or may be waived per CBC Section 1705A.3.3.
  - d. Continuous Batch Plant Inspection is waived for this project in compliance with CBC Section 1705A.3.3, subject to the following requirements:
    - 1) The concrete plan complies fully with the requirements of ASTM C94, Sections 9 and 10, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the [DSA] The certification shall indicate that the plant has automatic batching and recording capabilities.
    - 2) A licensed Weighmaster shall positively identify the quantity of materials and certify each load with a batch ticket.
    - 3) Batch tickets shall accompany the load and be transmitted to the Inspector of Record by the truck driver with the load identifies thereon. The load shall not be placed without a batch ticket identifying the mix. The Inspector

of Record shall keep a daily record of placements, identifying each truck, its load, and the time of receipt at the jobsite, and approximate location of deposit in the structure. A copy of the daily record shall be maintained.

e. Test Reports:

- 1) Testing Laboratory shall submit to Architect, Structural Engineer, Owner, and to the DSA one (1) copy of each report showing results of tests.
  - a) Report shall state whether materials were in conformance with specifications.
  - b) Report shall state whether the curing of the concrete slabs are within parameters required for future flooring installations.
- 2) Moisture and Alkalinity Tests.
  - a) Relative Humidity (RH).
  - b) Moisture Vapor Emission Report (MVER).

f. Certificates:

- 1) Submit three (3) copies of certificates.
  - a) Provide Vapor Retarder manufacturer's certificate of inspection and compliance to installation procedures.
  - b) Cement manufacturer's Mill Certificate of Compliance with the specification.
  - c) Certificates for aggregates and admixtures.

4. Closeout Submittals:

- a. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
- b. Warranty.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

- a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

2. Manufacturer/Supplier Qualifications:

- a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the Work.

3. Testing Laboratory Qualifications:

- a. Qualified Testing Laboratory and personnel approved by DSA.
  - 1) Cost of testing and inspection will be paid by the Owner unless otherwise specified. The Owner shall pay all costs of re-inspection and/or re-tests due to non-compliance with specifications and/or failures, but the Contractor shall reimburse the Owner for these tests when billed or deducted from its payment.

B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. All materials, equipment and placing operations shall be subject to inspection, tests and approval at all items. Testing Agent shall have free and unhampered access to all places where concrete materials are stored proportioned and mixed.

C. Mockups:

1. Provide mockups prior to application of work and prior to installation of any materials.

2. Mockups shall be used for establishing construction sequences, installation requirements of materials, and shall be representative for the intended end-use configuration.
3. Mockup Assemblies:
  - a. Polished Concrete Finishing: Mockups shall be the placement of concrete and shall integrate all other related work, but not limited to, Specification Section - POLISHED CONCRETE FINISHING.
  - b. Slab-On-Grade: Mockups shall be the finish and texture of concrete.
    - 1) Mockups shall be a minimum overall size of 3' x 3' x 4" thick panels.
    - 2) Provide Mockups for each texture and finish required.
4. Installation of Mockups:
  - a. The Project Inspector, the Architect, and Contractor's Superintendent shall observe the installation of materials and work.
  - b. Installation crew for the Mockups shall be the Cast-In-Place Concrete, Reinforcement and Polished Concrete Finishing installers for this project and installers, as necessary, of other related work.
  - c. Unacceptable Mockups shall be removed and reinstalled until the work is deemed to be in compliance with the project requirements and is acceptable by the Owner, Architect and Project Inspector.
5. Allow 24 hours for inspection of mockup before proceeding with work.
6. Protect the Mockups during the course of construction.
7. Remove mockup and dispose of materials when no longer required and when directed by the Architect at the end of the project.

D. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with other related work being performed.
    - 1) Schedule pre-construction conference with Vapor Retarder Manufacturer prior to installation at least one week prior to scheduled installation.
    - 2) Schedule pre-construction conference with Polished Concrete Contractor prior to installation to discuss specific requirements of the Polished Concrete Finishing requirements. Coordinate with Specification Section - POLISHED CONCRETE FINISHING.
  - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - c. Prior to submitting design mixes, review detailed requirements for preparing concrete design mixes and determine procedures for satisfactory concrete operations.
  - d. Review requirements for submittals, status of coordinating work, and availability of materials.
  - e. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications.
2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
    - 1) Schedule installation review at the start of installation with the Vapor Retarder Manufacturer to ensure all of the manufacturers written instructions are complied with.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

- 1) Prior to covering up the Vapor Retarder installation with concrete, have the Vapor Retarder manufacturer inspect and provide a certified report to the Architect the condition of the Vapor Retarder prior to being covered with concrete, and that the installation was in full compliance with the manufacturer's written instructions.
- b. Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.6 PROJECT CONDITIONS

### A. Environmental requirements:

#### 1. Cold Weather Requirements:

- a. Do not pour concrete unless air temperature is at least 40 degrees Fahrenheit and rising.
- b. Do not pour concrete on frozen ground or ice.
- c. Heat and otherwise prepare materials in accordance with ACI Standard 306.
- d. Maintain concrete temperature at 50 degrees Fahrenheit (minimum) the first three (3) days after pouring. Protect concrete from freezing the first six (6) six days, after placing.

#### 2. Hot Weather Requirements:

- a. Do not pour when temperature exceeds 90 degrees Fahrenheit.
- b. During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive Concrete temperatures or water evaporation, which will impair the required strength or serviceability of the member or structure.

## 1.7 WARRANTY

- A. Contractor's General Warranty: In accordance with Specification Section – WARRANTIES.
- B. Manufacturer's Warranty, in accordance with manufacturer's written standard warranty:
  - a. Warranty Period: One (1) Year.
- C. Installer's Warranty, in accordance with Specification Section – WARRANTIES.
  - a. Warranty period: One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

### 2.2 CONCRETE MATERIALS

1. Cement: Type I or II in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Chapter 3, and ASTM C 150 "Specifications for Portland Cement."
  - a. Natural (Grey) Portland Cement:
    - 1) LEHIGH PORTLAND CEMENT COMPANY.

- 2) MARTIN MARIETTA (TXI CEMENT COMPANY).
- b. White Cement:
  - 1) LEHIGH WHITE CEMENT
  - 2) MARTIN MARIETTA (TXI CEMENT COMPANY).
- c. Provide white cement for mixing when the Project requires patching for defective work, to match adjacent material color. See Specification Section - CAST-IN-PLACE CONCRETE, Part 3 Article titled "APPLICATIONS," the paragraph titled "Sack Finish."
2. Water: Clean and free from deleterious amounts of acids, alkalis, salts, organic material, or other substances that may be deleterious to concrete or reinforcing.
3. Aggregates:
  - a. Normal weight aggregates in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Chapter 3 and ASTM C33 "Standard Specifications for Concrete Aggregates." Crushed Granite or "Perkins" type aggregates are acceptable materials.
    - 1) Maximum Aggregate Size: 1-1/2 inches for standard aggregate.
    - 2) Coarse aggregate when tested in accordance with State of California Highways Test Methods 227 shall have a cleanliness value of 75 minimum.
    - 3) Fine aggregates when tested in accordance with State of California Highways Test Methods 217 shall have a sand equivalent of 75 minimum.
  - b. Lightweight aggregates shall be expanded shale, vacuum saturated or thermal quenched, and shall be in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Chapter 3, and ASTM C 330 "Standard Specification for Lightweight Aggregates for Structural Concrete."
    - 1) Maximum Aggregate Size: 3/4 inches for lightweight aggregates.
    - 2) Shrinkage control: Aggregate shall be prepared within 72 hours of being used or be re-wetted for 1/2 hour, twice a day if longer storage is required at the plant.
4. Admixtures: Admixtures shall be in accordance with the provisions of ACI 318 "Building Code Requirements for Structural Concrete and Commentary," Section 3.6, and shall not be used until prior approval from DSA has been obtained. Calcium Chloride is not permitted.
  - a. Fly Ash:
    - 1) Conform to ASTM C 618 "Specification for Coal Fly Ash and Raw or Calcined Natural Possolan for Use in Concrete."
    - 2) Class "C" Fly Ash is not permitted per CBC 1903A.6.
  - b. Water Reducing, High Range: On approval of DSA , the Architect and the Structural Engineer, the Contractor may use a High Range Water Reducing Admixture complying with ASTM C 494 "Specification for Chemical Admixtures for Concrete." Use one of the following materials:
    - 1) Finish Enhancing Water Reducer; "ADVA 170" by GCP APPLIED TECHNOLOGIES.
    - 2) ASTM C 494 "Specification for Chemical Admixtures for Concrete," Type F.
  - c. Fiber Reinforcing:
    - 1) Polypropylene / polyethylene macro synthetic fiber, complying with ASTM C 1116 "Standard Specification for Fiber Reinforced Concrete and Shotcrete."
    - 2) Specified product manufacturer: THE EUCLID CHEMICAL COMPANY.
      - a) TUF-STRAND SF.

- 3) Suitable for Slab On Grade and Above Grade Slab Construction.
- 4) UL Certified for composite metal deck construction.
- d. Shrinkage Control:
  - 1) Conform to ASTM C 494 "Specification for Chemical Admixtures for Concrete," Type S.
  - 2) Specified product manufacturer: SIKA CONTROL-40.
  - 3) Acceptable alternative product manufacturer:
    - a) THE EUCLID CHEMICAL COMPANY: "Eurcon SRA Floor".
  - 4) Verify and provide Shrinkage control compatible with Polished Concrete Finishing.
- e. Integral Concrete Waterproofing:
  - 1) Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate.
  - 2) Specified product manufacturer: XYPEX.
    - a) ADMIX C-500.

### 2.3 SLAB ON GRADE BASE MATERIALS

#### A. Rock Base:

- 1. Clean mixture of crushed stone or uncrushed gravel, in accordance with ASTM D 448 "Standard Classification for Sizes of Aggregate for Road and Bridge Construction."
  - a. Top Layer:
    - 1) Percent passing a 1-inch sieve: 100 percent.
    - 2) Percent passing No. 8 sieve: 0 to 5 percent.
  - b. Bottom Layer:
    - 1) Percent passing a 2-inch sieve: 100 percent.
    - 2) Percent passing No. 8 sieve: 0 to 5 percent.

#### B. Sand Base:

- 1. Sand to be washed and of natural siliceous or igneous origin, having hard, strong, and durable particles.
- 2. Sand shall comply with ASTM C 33 "Specification for Concrete Aggregates," generally as follows:
  - a. Percent passing 3/8 inch sieve: 100 percent.
  - b. Percent passing No. 4 sieve: 95 to 100percent.
  - c. Percent passing No. 50 sieve: 10 to 30 percent.
  - d. Percent passing No. 100 sieve: 2 to 10 percent.

### 2.4 VAPOR RETARDER

- A. Vapor Retarder: Physical Requirements in accordance with ASTM E 1745 "Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs," Class A Material, are as follows:
  - 1. Thickness: 15 mils minimum.
  - 2. Permeance: 0.01 Perms.
    - a. Maintain permeance of less than 0.01 perms after mandatory conditioning tests per ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover," Sections 8, 11, 12, and 13.

3. Tensile Strength: 45.0 lbf/in.
  - a. Per ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover," Sec. 9, ASTM D 828 "Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus:"
4. Resistance to Puncture: 2200 grams.
  - a. ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover", Sec. 10, ASTM D 1709 "Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method:"
5. Resistance to decay:
  - a. Per ASTM E 154 "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover."
6. Use pressure sensitive seam tape compatible with materials to be seamed in accordance with manufacturer's written recommendations.
  - a. Water vapor Transmission Rate: 0.3 perms or lower.
    - 1) Per ASTM E 96 "Test Methods for Water Transmission of Materials."
7. Vapor Proof Mastic: 0.3 perms or lower.
  - a. Water vapor Transmission Rate: 0.3 perms or lower.
    - 1) Per ASTM E 96 "Test Methods for Water Transmission of Materials."
8. Pipe Boots: Construct pipe boots from vapor retarder material, pressure sensitive seam tape, and /or mastic per manufacturer's written instructions.
9. Vapor Stakes:
  - a. Density: 0.0289 lb/cu.in.
    - 1) Per ASTM D 1505 "Test Method for Density of Plastics by the Density-Gradient Technique."
  - b. Specific Gravity: 0.0477.
    - 1) Per ASTM D 792 "Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement."
10. Specified product manufacturer: STEGO INDUSTRIES.
  - a. "Stego-Wrap" ("Yellow" color).
  - b. Acceptable alternative product manufacturers:
    - 1) EPRO SERVICES, INC.: "Ecoshield-E15" ("Red" color).
    - 2) W.R. MEADOWS: "Perminator 15" ("Green" color).

## 2.5 ACCESSORIES

- A. Bonding Agents: Polyvinyl acetate or acrylic base, mixed in accordance with the manufacturer's written recommendations.
  1. Specified product manufacturer: CONRAD SOVIG CO., INC.
    - a. "Cemlok-NE."
  2. Acceptable alternative product manufacturers:
    - a. THE EUCLID CHEMICAL COMPANY: "Eucoweld."
    - b. LARSON PRODUCTS CORPORATION: "Weld-Crete."
    - c. SONNEBORN: "Sonobond."
    - d. GCP APPLIED TECHNOLOGIES, INC: "Darweld C."
    - e. W.R. MEADOWS: "Deck-O-Weld."
- B. Mortar:
  1. Site Mix:

- a. Composed of Concrete Materials indicated in Specification Section - CAST-IN-PLACE CONCRETE, Part 2 Article titled "MATERIALS."
    - 1) Mix: One part cement to 3 parts aggregate (all aggregate shall pass No. 4 sieve).
    - 2) Mixing: Thoroughly mixed in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary."
  2. Concrete Mortar:
    - a. Greater than 1/4 inch thick: Floor leveling, patching and repair, non-shrink trowel applied concrete mortar where repair areas of fill.
  3. Epoxy Concrete Mortar:
    - a. Less than 1/4 inch thick: Floor leveling, non-shrink trowel applied epoxy concrete mortar where repair areas to fill.
    - b. Specified manufacturer: GENERAL POLYMER CORPORATION: "TPM 115."
    - c. Acceptable alternative product manufacturer:
      - 1) ANTI-HYDRO CORPORATION: "A-H Emery Epoxy Topping #170."
  4. Epoxy Mortar and Adhesive Materials:
    - a. Modified Polyamide, high modulus mortar, strength to match adjacent concrete or greater, in accordance with ASTM C 881 "Specification for Epoxy-Resin-Base Bonding Systems for Concrete," Grade 1, Type III, Class B & C, and in accordance with ACI 503.4, mixed in accordance with the manufacturer's written recommendations.
    - b. Specified product manufacturer: W.R. MEADOWS.
      - 1) "Rezi-Weld," "LV, 1000" or "Gel-Paste" as suitable for application.
    - c. Acceptable alternative product manufacturers:
      - 1) THE EUCLID CHEMICAL COMPANY: "Euco #456."
- C. Grout:
1. Strength to match adjacent concrete or greater, composed of specified Concrete Materials.
    - a. Mix: Same proportions as concrete mix except omit coarse aggregate and adjust water to produce a thick consistency. Provide mix design per CBC Section 1904A.2.
    - b. Mixing: In accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary," mixed in accordance with the manufacturer's written recommendation.
  2. Non-Shrink Grout: Flowable, non-shrink, self-leveling, non-staining, non-metallic grout, strength to match adjacent concrete or greater, and in compliance with ASTM C 1107 "Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," mixed in accordance with the manufacturer's written recommendation.
    - a. Specified product manufacturer:
      - 1) MINWAX CONSTRUCTION PRODUCTS COMPANY
        - a) "POR-ROK", Epoxy Grout.
    - b. Acceptable alternative product manufacturers:
      - 1) MASTER BUILDERS: "713."
      - 2) MASTER BUILDERS: "928."
  3. Drypack Grout: Non-staining, non-shrink, non-metallic grout, strength to match adjacent concrete or greater, and in accordance with ASTM C 1107 "Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," mixed in accordance with the manufacturer's written recommendation.
    - a. Specified product manufacturer:
      - 1) THE EUCLID CHEMICAL COMPANY: "Euco Dry Pack Grout."



- b. Acceptable alternative product manufacturers:
  - 1) W.R. MEADOWS: "Pac-It Grout."

## 2.6 JOINT FILLERS

- A. Waterstops: Provide polyvinyl chloride type waterstops, model number and size to fit the construction required, in accordance with the Corps of Engineers standard CRD-C 572.
  - 1. Specified product manufacturer:
    - a. GREENSTREAK PLASTIC PRODUCTS CO. "Polyvinyl Chloride Type."
- B. Fiber Expansion Joint Filler: 1/4" thick at vertical joints and 1/2" thick under thresholds (unless specifically noted otherwise), asphalt saturated fiber expansion joint filler, in accordance with ASTM D 1751 "Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)."
  - 1. Specified product manufacturer:
    - a. W.R. MEADOWS: "Sealtight Fiber Expansion Joint Filler."
  - b. Acceptable alternative product manufacturer:
    - 1) CELOTEX CORP.: "Flexcell."
    - 2) PHILLIP CAREY MFG. CO.: "Elastic Fiber Expansion Joint."
- C. Semi-Rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240 "Standard Test Method for Rubber Property – Durometer Hardness."
  - 1. Specified product manufacturer:
    - a. W.R. MEADOWS: "Rezi-Weld Flex."
- D. Polished Concrete Joint Filler: A two-component, 100% solids semi-rigid epoxy for filling control and construction joints in industrial concrete floors. This product supports the joint edges and reduces spalling of the edges caused by wheel traffic. EUCO 700 has been designed for use in compliance with ACI 302 recommendations for epoxy joint fillers used in control and construction joints.
  - 1. Specified product manufacturer: EUCLID "Euco 700."
- E. Foam Expansion Joint Filler: Extruded Polystyrene Foam products, in accordance with ASTM C 578 "Specification for Rigid, Cellular Polystyrene Thermal Insulation," thickness and depth as indicated on the drawings.
  - 1. Specified Product Manufacturer:
    - a. DOW CHEMICAL CORP.: "Styrofoam."
  - b. Acceptable alternative product manufacturers:
    - 1) U.C. INDUSTRIES: "Foamular."
- F. Redwood Joint Filler:
  - 1. Selected sound heart redwood in accordance with RIS "Standard Specifications for Grades of California Redwood Lumber," Section 211 (c) and Section 306.

## 2.7 CAST-IN CONCRETE ELEMENTS

## 2.8 CURING MATERIALS

- A. Curing Paper (Absorptive Covers): Products complying with:
  - 1. Specified product manufacturer:
    - a. FORTIFIBER CORPORATION: "Orange Label Sisalkraft."
  - 2. ASTM C 171 "Specification for Sheet materials for Curing Concrete."
- B. Slab Curing Compound (SCC): Provide liquid-type membrane-forming sealing compound, non-yellowing, VOC compliant cure and seal, complying with ASTM C 309 "Specification for

Liquid Membrane-Forming Compounds for Curing Concrete," Type I, Class A, that when dry is clear in color. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq.ft./gal.

1. Specified product manufacturer:
  - a. THE EUCLID CHEMICAL COMPANY: "Cure-Crete WB."
  - b. Acceptable alternative product manufacturers:
    - 1) W.R. MEADOWS: "Sealtight 1100 CLEAR."

- C. Clear Floor Sealer (CFS): Provide liquid-type membrane-forming sealing compound, non-yellowing, VOC compliant cure and seal, complying with ASTM C 309 "Specification for Liquid Membrane-Forming Compounds for Curing Concrete," Type I, Class A, that when dry is clear in color. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq.ft./gal.

1. Specified product manufacturer:
  - a. THE EUCLID CHEMICAL COMPANY: "Diamond Clear VOX."
  - b. Acceptable alternative product manufacturers:
    - 1) W.R. MEADOWS: "Sealtight VOComp 25."

## 2.9 FLOOR AND SLAB TREATMENTS

- A. Sack Finish Materials: For repair and patching of defective areas.

1. Provide sack finish materials composed of Concrete Materials indicated in Specification Section - CAST-IN-PLACE CONCRETE, Part 2 Article titled "MATERIALS." Sand shall be fine.
2. Mix: One part cement to one part fine sand with enough water to provide a creamy consistency.

- B. Cementitious Based Underlayment Compounds (CBUC): Provide free-flowing, self-leveling, pumpable, cement based compound for applications from 1-1/4 inch thick to feathered edges, 4500 psi minimum in accordance with ASTM C 109 "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. (or 50-mm) Cube Specimens)."

1. Specified product manufacturer:
  - a. ARDEX: "V-1200."
  - b. Acceptable alternative product manufacturers:
    - 1) MAPEI: "Ultraflex."
    - 2) QUIKRETE PRODUCTS CORP.: "QUIKRETE No. 1249."

## 2.10 TRUNCATED DOMES

- A. General:

1. Imprinting tools, forms and mats shall be in accordance with ADA Standards for Accessible Design, Section 4.29.2, CBC Sections 11B-705, California Government Code Section 4451(d), and IR 11B-4.

- B. Cast-In-Place Replaceable Mat:

1. Specified product manufacturer: ADA SOLUTIONS, INC.
2. Provide and install cast-in-place mat of homogeneous glass and carbon reinforced composite material.
3. Provide Integral Uniform Color throughout product, Yellow, approximate 33538 of SAE AMS-STD-595A.
4. Material Physical Characteristics:
  - a. Compressive Strength: greater than 28,000 psi per ASTM D 695.
  - b. Tensile Strength: greater than 11,000 psi per ASTM D 638.
  - c. Water Absorption: less than 0.10 percent per ASTM D 570.
  - d. Slip Resistance: less than 1.00 Wet/Dry Static per ASTM C 1028.
  - e. Flame Spread Index: less than 25 per ASTM E 84.
5. Dimensions: Statistics of Truncated Domes per CBC 11B-705.1:

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- a. Base Diameter of Dome: 0.90 to 0.92 inch.
- b. Top Diameter of the Dome: 0.45 to 0.47 inch.
- c. Height of the Dome: 0.2 inch.
- d. Center to Center Spacing of Domes in-line pattern: 2.3 to 2.4 inches.
- e. All edges of panel shall have a square edge.

### 2.11 CONCRETE MIXES, GENERAL

- A. Mix Design and Proportions in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary:"
- B. Initial mix design shall be prepared for all concrete by recognizing testing laboratory approved by Architect. In the event that additional mix designs are required due to depletion of aggregate sources, aggregate not conforming to Specifications, or at request of Contractor, these mixes shall be prepared as above.
- C. Contractor shall notify the Testing Laboratory and Architect of intent to use concrete pumps to place concrete so that mix designs can be modified accordingly.
- D. Mix designs with Fly Ash content greater than 15 percent of the total weight of cementitious materials shall be proportioned by ACI 318 "Building Code Requirements for Structural Concrete and Commentary."
  - 1. Provide 3 percent air entrainment typical, 6 percent for mixes with  $f'_c$  greater than 4,000 psi when required.
- E. Owner's testing laboratory shall review all mix design before submittal.

### 2.12 CONCRETE MIXES

- A. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 "Building Code Requirements for Structural Concrete and Commentary" at 28 days and shall be proportioned within the following limits:
- B. Foundations: Use for unexposed foundation concrete except as otherwise specified:
  - 1. Strength: 3,000 psi at 28 days.
  - 2. Max. Aggregate Size: 1-1/2 inch.
  - 3. Max. Water/Cement Ratio: 0.58.
  - 4. Admixture: Water Reducing.
  - 5. Weight: 145 pcf.
- C. Building Slab On Grade: Use for interior building slab on grade, except as otherwise specified:
  - 1. Strength: 4,000 psi at 28 days.
  - 2. Max. Aggregate Size: 1 inch.
  - 3. Max. Water/Cement Ratio: 0.45.
  - 4. Admixture: Water Reducing + Fly Ash.
  - 5. Weight: 145 pcf.
- D. Site: Use for exterior concrete slabs on grade such as walks, site work, mechanical and electrical pads and miscellaneous site items:
  - 1. Strength: 3,000 psi at 28 days.
  - 2. Max. Aggregate Size: 1 inch.
  - 3. Max. Water/Cement Ratio: 0.60.
  - 4. Admixture: Water Reducing.
  - 5. Weight: 145 pcf.

### 2.13 CONCRETE MIXING

- A. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143 "Test method for Slump of Hydraulic-Cement Concrete," shall fall within the following limits:
  - 1. For General concrete placement: 3 inch plus or minus 1 inch.

- a. Polished Concrete Mix: 5" maximum.
  2. Mixes employing the specified high range water reducer shall provide a measured slump not to exceed 7 inch +/- 1 inch after dosing, 2 inch +/- 1 inch before dosing.
    - a. Polished Concrete Mix: 6" maximum if using water reducing admixture in lieu of water.
  3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required, to provide a workable consistency for pump mixers. Water shall not be added in route by truck or at the jobsite without written review by the Architect.
- B. Mixing:
1. Equipment: All concrete shall be machine mixed. Provide adequate equipment and facilities for accurate measurement and control of materials.
  2. Method of Mixing to comply with ACI 318 "Building Code Requirements for Structural Concrete and Commentary:"
    - a. Transit Mixing: Comply with ASTM C 94 "Specification for Ready-Mixed Concrete." Ready mixed concrete shall be used throughout, except as specified below.
      - 1) On-Site Mixing: Use only if method of storing material, mixing of material and type of mixing equipment is approved by Architect.
      - 2) Approval of site mixing does not relieve Contractor of any other requirements of Specifications.
  3. Mixing Time: After mix water has been added, concrete shall be mixed not less than 1-1/2 minutes nor more than 1-1/2 hours. Concrete shall be rejected if not deposited within the time specified.
  4. Admixtures:
    - a. Use automatic metering dispenser to introduce admixture into mix. Dispenser shall be recommended and calibrated by admixture manufacturer.
      - 1) Integrally Colored Concrete Color Pigment: Follow the manufacturers written recommendations for proper mixing of the selected pigment color.
    - b. Water Reducers may be used in concrete slabs on grade identified with a Polished Concrete Finish - coordinate with Specification Section - POLISHED CONCRETE FINISHING.
    - c. Admixtures shall be charged into mixer as a solution and shall be dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighed or measured by volume as recommended by manufacturer. Accuracy of measurement of any admixture shall be within plus or minus 3 percent.
    - d. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence, and provided further that admixtures used in that combination retain full efficiency and have no deleterious effect on concrete or on properties of each other.
    - e. All admixtures are to be approved by Architect prior to commencing this work.
  5. Re-tempering:
    - a. Concrete shall be mixed only in quantities for immediate use. Concrete, which has set shall be discarded, not re-tempered.
    - b. Indiscriminate addition of water to increase slump is prohibited.
    - c. When concrete arrives at project with slump below what is suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded.
      - 1) Water shall be incorporated by additional mixing equal to at least half of total mixing time required.
      - 2) Any addition of water above that permitted by limitation of water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain proper water-cement ratio.

- 3) Such additions shall only be used if approved by the Architect.
  - 4) In any event, with or without addition of cement, not more than 2 gallons of water per cubic yard of concrete, over that specified in the design mix, shall be added.
6. Cold Weather Batching: When temperature is below 40 degrees F, or is likely to fall below 40 degrees F during a 24 hour period after placing, provide adequate equipment for heating concrete materials.
- a. No frozen materials or materials containing ice shall be used.
  - b. Temperatures of separate materials, including mixing water, when placed in mixer shall not exceed 100 degrees F.
  - c. When placed in forms, concrete shall have a temperature between 50 degrees F and 85 degrees F.
7. Hot Weather Batching: Concrete deposited in hot weather shall have a placing temperature below 85 degrees F. If necessary, ingredients shall be cooled to accomplish this.

## 2.14 FINISHES

### A. Slab Finishes:

1. Tooled Finishes:
  - a. Scratch Finish: Apply scratch finish to slab surfaces to receive concrete floor topping or mortar setting beds for tile, and other bonded applied cementitious finish flooring material.
  - b. Float Finish: Apply float finish to slab surfaces to receive trowel finish and other finishes as specified; membranes, elastic waterproofing, elastic roofing, or sand-bed terrazzo.
  - c. Trowel Finish: Apply a non-slip trowel finish to surfaces to be covered with resilient flooring, thin-set ceramic or quarry tile, paint or another thin film-finish coating system
  - d. Sweat Trowel Finish: Apply a non-slip steel trowel ("sweat") finish (tight circular motion pattern approved by the Architect) to slab surfaces exposed to view.
    - 1) All exterior concrete paving and concrete finishes, at exterior concrete platforms, steps, ramps, walks, and other areas requiring non-slip finishes, unless otherwise indicated, shall have a non-slip finish (as defined by PCA - Portland Cement Association "Design and Control of Concrete Admixtures") applied in the following manner:
      - a) Medium Finish: On all surfaces having a pitch of less than 5 percent, Equivalent to a "Medium Finish" term, with at least a 1/16" reveal.
      - b) Rough Finish: On all surfaces having a pitch greater than 5 percent, Equivalent to a "Heavy Finish" term, with at least a 1/8" reveal.
  - e. Broom Finish: All concrete paving and concrete finishes, and exterior concrete platforms, steps, ramps and other areas requiring non-slip finishes, unless otherwise indicated, shall have a non-slip broom finish (as defined by PCA - Portland Cement Association "Design and Control of Concrete Mixtures") applied in the following manner:
    - 1) Medium Broom Finish.
      - a) 1/16" reveal.
    - 2) Rough Broom Finish.
      - a) 1/8" reveal.
  - f. Aggregate Finish: Apply aggregate finish to selected concrete surfaces as indicated on the drawings.
    - 1) "Cast" Aggregate Finish.
    - 2) "Washed" Aggregate Finish.

- g. Sandblast Finish:
  - 1) "Light Sandblast Finish:" 1/16 inch reveal.
  - 2) "Medium Sandblast Finish:" 1/4 inch reveal.
- h. Stamped Concrete Finish:
  - 1) Pattern: To be selected by Architect.
- i. Truncated Dome Finish:
  - 1) Tactile Warning with colored hardener and sealer required to separate the pedestrian way from the vehicle way.
- 2. Applied Finishes:
  - a. Slab Curing Compound (SCC): Used as a curing compound for exterior slabs on grade with no flooring applications.
  - b. Clear Floor Hardener Finish (CFH): Used to prevent "dusting," where a light degree of hardness is required to the interior slab finish.
  - c. Colored Floor Hardener Finish (COFH): Used to prevent "dusting," where a medium degree of hardness is required to the interior slab finish.
  - d. Colored Wear-Resistant Finish (COWR): Used for slab surfaces where a heavy degree of hardness is required.
    - 1) This product must have an application of colored [**wax**][**sealer**].
- 3. Repair finishes (Vertical surfaces):
  - a. "Sack Finish:" Applied to defective surfaces mixed to the color and consistency required to match the adjacent materials in color and strength.

## 2.15 SOURCE QUALITY CONTROL

- A. Test, Inspection:
  - 1. Inspection of Mix:
    - a. Quality and quantity of material used shall be subject to continuous inspection by a qualified person. Sampling and testing of cement and aggregates in accordance with Title 24, Part 1, Section 4-335, and CBC Section 1705A, and Table 1705A.3.
    - b. Maintain sources of material supply constantly after approval of concrete mix.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Contractor shall inspect bearing soil and report soft or loose unsuitable bearing soil to Architect.
  - 2. Architect will furnish Contractor with corrective measures necessary to remedy field condition.
  - 3. Do not pour concrete until suitable bearing surfaces are achieved.
  - 4. At Engineered Fill, remove soft and loose unsuitable fill and replace with concrete. Cost shall be paid by Contractor.
  - 5. Contractor shall inspect and identify any site conditions and/or design information that prevents the Contractor from complying with the laws, regulations and/or building codes governing ADA access compliance.

### 3.2 PREPARATION

- A. Transportation of Concrete:
  - 1. Handle Concrete from mixer to place of final deposit as rapidly as practical by methods which shall prevent the separation or loss of the ingredients in accordance with ACI 304.3R "Heavyweight Concrete Measuring, Mixing, Transporting, and Placing."
  - 2. Do not move concrete horizontally by means of vibrators.

3. Deposit concrete as nearly as practical at its final position in a manner which, will ensure that required quality is obtained.
  4. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.
- B. Protection:
1. At old concrete or concrete which has begun to set upon which Concrete is to be placed:
    - a. Surface shall be level, cleaned of all laitance and rough with solidly embedded large aggregate exposed.
    - b. Rough surface by chipping entire surface not earlier than 5 days after set, by high pressure hosing (80 pounds per square inch) 2 to 4 hours after placing or by sand blasting with coarse silica sand, roughness amplitude shall be at least 1/4 inch.
    - c. Not more than 1/2 hour prior to pouring concrete, place 2 inch thick uniform layer of grout on old concrete.
- C. Surface preparation:
1. Prepare base materials prior to forming footings and trenches.
  2. Remove all water from excavation. Divert flow of water through drains using methods to avoid washing over freshly deposited concrete.
  3. Remove hardened concrete, wood chips, shavings and other debris from interior of forms and from reinforcing steel by vacuum process.
    - a. No wooden ties or blocking shall be left in concrete except where indicated for attachment of other work.
  4. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
  5. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
  6. Reinforcing steel shall have been placed, tied and supported.
  7. Coordinate with Specification Section - SOIL TREATMENT before placing any concrete.
  8. Embedded work of all trades shall be in place in the forms and adequately tied and braced.
  9. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale or other contaminants that will destroy or reduce bond.
  10. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.
  11. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.
  12. No concrete shall be placed until formwork, reinforcement, and embedded items have been approved by the Architect.
    - a. Clean forms of all debris and remove standing water.
    - b. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete.
    - c. Concrete shall not be placed against reinforcing steel that is hot to the touch.
  13. Provide runways or other approved means for wheeled equipment. Do not wheel equipment over reinforcing or formwork.

### 3.3 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

### 3.4 INSTALLATION OF BASE

#### A. Placing of Rock Base:

1. Shall occur after scarification and compaction operations.
2. Preparation of sub-grade and selection and placing of Rock Base subject to continuous inspection and supervision of Geotechnical Engineer.
3. Compact Rock Base to a density of not less than ninety-two (92) percent, but not more than ninety-five (95) percent, in accordance with Test Designation ASTM D 1557 "Test methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."
  - a. Density of each layer of Rock Base shall be tested and verified that it meets required density of Geotechnical Engineer prior to placing any other succeeding layers.
4. Roll Rock Base under interior (and any designated exterior slabs) to smooth surface, free of large or sharp particles.
5. Conduct work to minimize inspection costs.
6. Costs of initial compaction tests shall be borne by the Owner. Contractor shall pay for all re-tests required due to failure of initial tests.

#### B. Placing of Sand Base:

1. Shall occur after scarification and compaction operations.
2. Preparation of any sub-grade Engineered Fill, placing of Vapor Retarder, and placing of Sand Base subject to continuous inspection and supervision of Geotechnical Engineer.
3. Compact Sand Base to a density of not less than ninety-two (92) percent, but not more than ninety-five (95) percent, in accordance with Test Designation ASTM D 1557 "Test method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lb./sq.ft.)."
  - a. Density of each layer of Sand Base shall be tested and verified that it meets required density of Geotechnical Engineer prior to placing any succeeding layers.
4. Roll Sand Base under interior (and any designated exterior slabs) to smooth surface, free of large or sharp particles.
5. Conduct work to minimize inspection costs.
6. Costs of initial compaction tests shall be borne by the Owner. Contractor shall pay for all re-tests required due to failure of initial tests.

### 3.5 INSTALLATION OF VAPOR RETARDER

#### A. General:

1. Follow ASTM E 1643 "Standard Practice and Procedure for Installation of Vapor Retarder used in Contact with Earth Fill Under Concrete Slabs."
2. Level, tamp or roll Earth Fill or Base Material beneath the slab in thickness as indicated on the drawings. Remove all sharp objects that could puncture the Vapor Retarder.
3. Unroll Vapor Retarder over the area where the slab is to be poured, with the longest direction parallel with the direction of the pour.
4. Cut to size, if necessary. Vapor Retarder used shall completely cover the pour area.
5. All joints/seams, both lateral and butt, shall be overlapped six (6) inches and taped using a compatible four (4) inch wide Pressure Sensitive Seaming Tape.



- a. Tape areas shall be free from dust, dirt and moisture to allow maximum adhesion of the pressure sensitive tape.
- b. Vapor Retarder shall overlap six (6) inches and seal to top of all footings and against vertical walls. Provide manufacturer's written recommended sealant.
- 6. Repair any damaged areas in accordance with manufacturer's written recommendations, and overlap repairs a minimum of six (6) inches in all directions with Vapor Retarder Material, Pressure Sensitive Tape, and Vapor Proofing Mastic.
- 7. Follow manufacturer's written recommendations for vertical wall applications.
- B. Penetrations:
  - 1. Seal all penetrations and check that all pipe, ductwork, rebar, wire penetrations and block-outs are thoroughly sealed.
  - 2. Single Pipe Penetrations may be sealed using pipe boot constructed from the product.
    - a. Cut a piece of plastic, width - 12 inches, length - 1 and 1/2 times the circumference of the pipe with scissors; cut slits half the width of the film, and wrap the boot around the pipe; tape onto pipe and completely tape the base to the Vapor Retarder.
  - 3. Multiple pipe penetrations in close proximity and very small pipes may be sealed using Vapor Proofing Mastic.
    - a. Cut out small area around pipes; cut a patch of Vapor Retarder extending at least 6 inches past the cut out in all directions; cut X's or small circles in the patch and install over pipes; overlap at least 6 inches and tape; build up 40-60 mils of mastic, or as needed to completely fill all voids between the pipe and Vapor Retarder.
  - 4. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.
    - a. In the case that forms must be used vapor stakes should be used to hold forms in place.
    - b. Penetrate plastic with stake; treat stake as pipe penetration (see above "penetration" paragraphs; leave stake permanently in concrete; using a power saw, cut stake off above the seal, but below the concrete finished surface; the lower portion of the vapor stake remains in place, permanently plugging the penetration.

### 3.6 JOINTS

- A. General: Construct joints straight, horizontal, true with faces perpendicular to surface plane of concrete and free of "overhangs" or "lips" to line.
- B. Construction Joints:
  - 1. Location: as indicated or as approved by Architect.
  - 2. Install as to least impair strength of structure, appearance of concrete and shall conform to typical details and in accordance with ACI Standards.
  - 3. Joints between concrete and masonry shall be considered construction joints.
  - 4. Spacing: Pour lengths shall be as follows, unless specifically noted otherwise.
    - a. Foundations: 100 feet maximum
    - b. Walls: 60 feet maximum
    - c. Structural Slabs: 60 feet o.c. maximum
    - d. Interior Slabs on grade: 30 feet o.c. maximum
    - e. Exterior Slabs on grade: 30 feet o.c. maximum
  - 5. Installation:
    - a. Construction joints shall have level tops, vertical sides.
    - b. Construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix.
    - c. See drawings for doweling and required keys.
    - d. Roughen construction joints by any of the following methods:
      - 1) By sandblasting joint.

- 2) By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
  - 3) By chipping and wire brushing.
  - 4) Vertical construction joints need not be roughened
  - e. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the Architect.
  - f. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).
  - g. Before placing regular concrete mix, horizontal and vertical joint surfaces shall be covered with a layer of mortar composed of cement and fine aggregate of same proportions as that used in prescribed mix, but omitting coarse aggregate.
- C. Expansion Joints:
1. Location: as indicated or as approved by Architect.
    - a. Exterior slabs on grade: locate at walks, curbs, gutters, etc.
      - 1) Locate at each side of structure/vertical surface, curb transition opposite apron joints, end of curb returns, and back of curb when adjacent to walk.
    - b. Interior slabs on grade: Install at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  2. Spacing:
    - a. Exterior Slabs on grade: 30 feet o.c. maximum, unless otherwise noted.
    - b. Interior Slabs on grade: as indicated.
  3. Installation:
    - a. Install Expansion Filler in expansion joints.
      - 1) Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless noted otherwise.
      - 2) Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface.
      - 3) Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
      - 4) "Glue" Expansion Filler to edge of previous pour.
    - b. When concrete has taken initial set, the edge of concrete surface shall be rounded by tooling to top of Expansion Filler.
    - c. Interrupt reinforcing at all expansion joints.
- D. Control Joints (Contraction Joints):
1. Location: as indicated or as approved by Architect.
    - a. Construction and expansion joints shall be considered as control joints.
  2. Spacing:
    - a. Exterior Slab on grade: 10 feet o.c. maximum, unless otherwise noted.
    - b. Interior Slab on grade: 15 feet o.c. maximum.
      - 1) Maximum area not to exceed 225 sf.
      - 2) Maximum length to width not to exceed 1 to 1 1/2 ratio.
      - 3) Conform to bay spacing wherever possible (at column centerlines, half bays, third bays, etc).
  3. Installation: Form weakened-plane control joints, sectioning concrete into areas as indicated.
    - a. Use saw cuts 1/8 inch wide by 1/4 of slab depth, or tooled joints with rounded edges 1/8 inch wide by 1/4 of slab depth, unless specifically noted otherwise.

- b. Control joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing without dislodging aggregate and with no spalling of edges on either side of the joint.
- c. Slab reinforcing need not be terminated at control joints.

### 3.7 CONCRETE PLACEMENT

#### A. Placing of Concrete - General:

1. All concrete shall be placed under direct observation of the Owner's Inspector.
2. Notify Owner's Inspector not less than forty-eight (48) hours prior to pouring of first concrete.
3. Place concrete in accordance with ACI 304.3R "Heavyweight Concrete Measuring, Mixing, Transporting, and Placing."
4. Do not place Concrete outside of regular working hours except to complete work already started.
5. Do not use Concrete which has been mixed for a period longer than one and one-half (1-1/2) hours or which has started to stiffen or set.
6. Re-mixing on concrete, which has started to set, shall not be permitted.
7. Pouring of concrete shall be a continuous operation until the completion of the Section or Panel in accordance with ACI 304.3R "Heavyweight Concrete Measuring, Mixing, Transporting, and Placing."
8. Consolidation:
  - a. Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing.
  - b. Power vibrators shall be used immediately following pour.
  - c. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Architect.
  - d. In no case shall vibrators be placed against reinforcing steel or used for extensive shifting of deposited fresh concrete.
  - e. Provide and maintain standby vibrators, ready for immediate use.
9. Keep a record of times, dates and locations of all concrete placing operations for the duration of the project. Record shall be available to Architect and Owner's Inspector at all times.
10. In no case shall concrete be poured into an accumulation of water ahead of pour.
11. If any concrete operation, once planned, can not be completed in a continuous operation, placement shall stop at temporary bulkheads located where resulting construction joints will least impair the strength of the structure. The location of construction joints shall be as shown on the drawings, or as approved by Architect.
12. Hot Weather Concreting: Unless otherwise directed by the Architect, perform all work in accordance with ACI 305.1 "Specification for Hot Weather Concreting" when air temperature rises above 75 degrees F and the following:
  - a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.
  - b. Aggregate: Keep aggregate piles continuously moist by sprinkling with water.
  - c. Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 85 degrees F.
    - 1) The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.
    - 2) Dampen subgrade and formwork before placing concrete.
    - 3) Remove all excess water before placing concrete.
    - 4) Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete.

- d. Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection for 14 days minimum.
  - 13. Cold Weather Concreting: Follow recommended ACI 306R "Cold Weather Concreting" procedures when air temperature falls below 40 degrees F, as approved by Architect.
    - a. Concrete placed in freezing temperature shall have a temperature of not less than 50 degrees F.
    - b. Maintain this temperature for at least 7 days.
    - c. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from Architect.
  - 14. Concrete shall not be placed if sand overlying the vapor retarder barrier has been allowed to attain a moisture content greater than 5 percent due to precipitation or excessive watering.
- B. Placing of Concrete at Footings, Walls, Columns, etc.:
- 1. Concrete shall be placed in layers not to exceed twenty-four (24) inches in depth, and shall be thoroughly compacted.
    - a. Wait forty minutes before placing next layer.
    - b. Re-vibrate six (6) inches into previous lift before next lift is added.
    - c. Locate top of lift at or below top of wall opening.
  - 2. Use openings in forms, elephant trunks or other approved methods to prevent accumulation of concrete on forms and reinforcement above the level of pour.
    - a. Unconfined free falls shall not exceed five (5) feet.
  - 3. Where placing or consolidation is restricted by close assemblage of reinforcing and/or forms use a Modified Mix Concrete with smaller aggregate and/or pour 3 inches of neat grout into form prior to regular mix.
  - 4. Concrete shall not be flowed horizontally along forms.
- C. Placing of concrete at slab on grade:
- 1. Slabs on grade shall not be poured until the sub-grade has been thoroughly compacted and properly prepared, complete with vapor retarder or barrier, nor until reinforcement and inserts are securely fastened in place.
    - a. Sub-grade above and below vapor retarder where installed resilient flooring products or rubber/vinyl-backed products are proposed to be installed shall not be moistened prior to pouring concrete.
  - 2. No greater area shall be poured at one time than can be properly finished without checking.
  - 3. Slabs on grade shall be laid out in a checkerboard pattern when applicable. Pour and allow alternate slabs to set.
    - a. Fill out balance of checkerboard pattern with subsequent pour.
  - 4. Concrete shall be poured as dry as possible, consistent with good workmanship.
    - a. Water shall not be added to mix to improve workability without approval of the Architect.
  - 5. Concrete shall be compacted by hand tamping and by mechanical vibration.
    - a. After the concrete is thoroughly compacted, the surface shall be screeded off, any surface water removed and finish applied as specified.
  - 6. The Contractor may, on approval of DSA and the Architect, use a Finish Enhancing Admixture (High Range Water Reducer) in accordance with Article Titled MATERIALS.
    - a.
- D. Placing of concrete on above grade slabs:
- 1. General: In addition to all the preceding requirements for pouring concrete, on above grade slabs the contractor shall coordinate the pour so as to not over stress the structure

and evenly distribute the pours to minimize deflection for the structural members in order to minimize slab cracking.

E. Placing of concrete by pumps:

1. If pumps are used to place concrete, the fines (3/8" and smaller) shall not exceed 45 percent of the total volume of aggregate. Standby equipment must be provided to insure completing pours to planned cutoffs.
2. Pumps shall handle concrete at a uniform rate without bleeding or segregation of aggregates. Concrete from end of the hose shall have a free fall not to exceed four (4) feet. Aluminum pipe shall not be used to transport pumped concrete.

3.8 INSTALLATION OF SHRINKAGE-RESISTANT GROUT

A. Installation of nonshrink grout or drypack: Install under base plates immediately after erection of structural steel.

1. General: Ram in thin layers, using a short length of ram, the free end of which shall be struck with a heavy hammer or mallet, several blows for each layer, to compact the mixture. When completed, the exposed drypack shall show slight indication of moisture.
2. Curing: Cure with a curing compound or with moisture-retaining barrier kept wet.

3.9 APPLICATION

A. Finishes application:

1. Screed, consolidate, and level concrete slabs prior to any Finishes.
2. Tooled Finishes:
  - a. Scratch finish:
    - 1) After screeding, consolidating, and leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
  - b. Float finish:
    - 1) After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.
    - 2) Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.
    - 3) Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power units.
    - 4) Finish surfaces to tolerances indicated.
    - 5) Cut down high spots and fill low spots.
    - 6) Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
  - c. Trowel finish:
    - 1) After floating, begin first trowel-finish operation using a power-driven trowel.
      - a) Begin final troweling when surface produces a ringing sound as trowel is moved over surface.
      - b) Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and finish surfaces to tolerances indicated.
      - c) Grind smooth any surface defects that would telegraph through applied floor covering system.
    - 2) Where thin set ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
    - 3) Apply a non-slip "Sweat Trowel" finish (tight circular motion approved by the Architect) to exterior slabs in the final troweling operation.

- d. Broom finish:
  - 1) Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route for the indicated broom finish.
  - 2) Medium Broom Finish: On all surfaces having a pitch of less than 6 percent.
  - 3) Rough Broom Finish: On all surfaces having a pitch of more than 6 percent.
- e. Aggregate Finishes:
  - 1) "Cast" Aggregate Finish method:
    - a) After completing float finishing and before starting trowel finish, uniformly spread 25 lb. of dampened aggregate per 100 sq. ft. of surface.
    - b) Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
    - c) After broadcasting and tamping, apply trowel finishing as specified.
    - d) After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose aggregate.
    - e) Quality of finish shall be in accordance with approved mock-up.
  - 2) "Washed" Aggregate Finish method:
    - a) When concrete has cured sufficiently to hold aggregate, but soft enough to remove surface cement, wash and brush surface to expose aggregate.
    - b) Quality of finish shall be in accordance with approved mock-up.
- 3. Sandblast Finishes:
  - a. "Light Sandblast Finish" by the Abrasive Blast Method:
    - 1) Miscellaneous concrete structures as indicated on the drawings.
    - 2) Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.
    - 3) Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample or mockup.
    - 4) Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.
    - 5) Sufficient to expose fine aggregate with occasional exposure of coarse aggregate as follows:
      - a) Maximum Reveal: 1/16 inch.
      - b) Cracks, voids, protrusions, spalls, or non-uniform color or texture will not be acceptable.
  - b. "Medium Sandblast Finish" by the Abrasive Blast Method:
    - 1) Miscellaneous concrete structures as indicated on the drawings.
    - 2) Perform abrasive blasting after compressive strength of concrete exceeds 2000 psi. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at same age for uniform results.
    - 3) Surface Continuity: Perform abrasive-blast finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work. Maintain required patterns or variances in depths of blast to match design reference sample or mockup.

- 4) Abrasive blast corners and edges of patterns carefully, using backup boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match design reference sample or mockup.
  - 5) Sufficient to expose fine aggregate with occasional exposure of coarse aggregate as follows:
    - a) Maximum Reveal: 1/4 inch.
    - b) Cracks, voids, protrusions, spalls, or non-uniform color or texture will not be acceptable.
4. Stamped Concrete:
- a. Stamp overlay surfaces according to manufacturer's instructions. Plan stamp layout prior to application of stamps
  - b. Liquid Release Agent Application: Apply a liberal coat of liquid release agent to cementitious stampable overlay when set sufficiently to achieve a clean impression
  - c. Stamping
    - 1) Stamp perimeter of pour, using texture skins.
    - 2) Accurately align stamp mats in sequence and tamp into cementitious stampable overlay to produce imprint pattern, texture, and depth of imprint, according to manufacturer's instructions. Remove stamps from cementitious stampable overlay immediately.
    - 3) Stamp edges and surfaces unable to be imprinted with stamp mat with texture skins.
    - 4) Use stamp tools to imprint grout lines at edges and surfaces unable to be imprinted with stamp mats.
5. Truncated Dome Finishes:
- a. Cast-In-Place Replaceable Truncated Domes Mat:
    - 1) Installation: Install into freshly poured concrete per manufacturer's instructions.
      - a) Tamp and vibrate into freshly poured concrete to ensure that there are no voids or air pockets.
      - b) Field level flush to the adjacent concrete surfaces to permit proper water drainage and eliminate tripping hazards.
    - 2) Cut and set into size and configuration as indicated.
      - a) Minimize any cantilever effect when cutting between successive embedment ribs.
      - b) Top of the body shall be fully seated and flush with adjacent concrete substrate.
    - 3) Orient domes such that the rows of inline truncated domes are parallel with the direction of the ramp.
      - a) When multiple mats are used, the truncated domes shall be aligned between the tactile warning surfaces and throughout the entire tactile warning surface installation.
    - 4) Do not create voids between the underside of the tile and the concrete.
      - a) No walking, leaning or external forces shall be placed during and after installation and the concrete curing stage.
    - 5) Remove protective plastic sheeting within twenty four (24) hours of installation.
    - 6) Clean mat by method specified by manufacturer.
    - 7) If requested, clean mats not more than four (4) days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project.
    - 8) All traffic is prohibited until adhesive and sealant have cured.

- b. Surface Applied Truncated Domes Mat:
  - 1) Installation:
    - a) Mechanically fasten and adhere panels to existing concrete substrate.
    - b) Fasteners shall be countersunk Stainless Steel with Powder Coated head to match mat color.
    - c) Minimum 1-1/2" penetration into existing concrete substrate.
    - d) Minimum 12 fasteners per panel.
    - e) Provide continuous urethane adhesive around perimeter and across the center of mat prior to mechanically attaching.
    - f) Provide continuous seal at outside perimeter of mat per manufacturers recommendations.
    - g) Clean excess adhesive and sealant.
    - h) All traffic is prohibited until adhesive and sealant have cured.
- 6. Applied Finishes:
  - a. Slab Curing Compound Finish (SCC):
    - 1) Apply Clear Slab Curing Compound Sealer Finish in accordance with manufacturer's written recommendations, and in exterior areas only as indicated by the Contract Documents.
  - b. Clear Floor Sealer Finish (CFS):
    - 1) Apply Clear Floor Sealer Finish in accordance with manufacturer's written recommendations, and in areas as indicated by the Contract Documents.
  - c. Clear Floor Hardener Finish (CFH):
    - 1) Apply Clear Floor Hardener Finish in accordance with manufacturer's written recommendations, and in areas as indicated by the Contract Documents.
  - d. Colored Floor Hardener Finish (COFH):
    - 1) Apply Colored Floor Hardener Finish in accordance with manufacturer's written recommendations, and in areas as indicated by the Contract Documents.
  - e. Colored Wear-Resistant Finish (COWR):
    - 1) Apply dry shake materials for the colored wear-resistant finish at a minimum rate of 100 lb per 100 sq. ft.
    - 2) Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dry shake material over the concrete surface, and embed by power floating.
      - a) Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.
    - 3) After broadcasting and floating, apply a trowel finish as specified.
      - a) Cure slab surface with a curing compound recommended by the dry shake material manufacturer.
      - b) Apply the curing compound sealer immediately after the final finishing.
- 7. Repair Finishes:
  - a. Sack Finish: Use only enough water as required for handling and placing.
    - 1) Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than one (1) inch.
      - a) Make edges of cuts perpendicular to the concrete surface.



- b) Thoroughly clean, dampen with water, and brush-coat the area to be patched with a bonding agent.
    - c) Place patching mortar before bonding agent has dried.
  - 2) For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color.
    - a) Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching.
    - b) Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Concrete curing and protection:
  - 1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
    - a. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material.
    - b. Apply according to manufacturer's written instructions after screeding and bull floating, but before power floating and troweling.
  - 2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than ten (10) days.
  - 3. Formed Surfaces:
    - a. Wet forms immediately after pouring.
    - b. Keep forms and exposed surfaces wet until forms are removed.
    - c. Keep all surfaces wet after forms are removed for ten (10) days after placement of Concrete.
  - 4. Concrete Slab Curing Methods:
    - a. One spray coat of clear curing compound.
      - 1) Agitate curing compounds thoroughly by Mechanical means continuously during use and spray or brush uniformly in accordance with manufacturer's written recommendations.
      - 2) Not applicable for:
        - a) Slabs designated for Adhesively Applied Floor Coverings.
        - b) Slabs designated for Resinous Flooring on top of concrete slab.
        - c) Slabs designated for Polished Concrete Finishing.
    - b. Curing paper:
      - 1) Anchor the paper or film securely and seal all edges in such a manner as to prevent moisture escaping from concrete.
      - 2) Protect all exposed surfaces with "Curing Paper." Curing Paper shall be kept moist.
      - 3) Contractor shall be responsible for protection of finished concrete against injury by rain, cold, vibration, animal tracks, marking by visitors, vandalism, etc.
      - 4) Required for the following:
        - a) All interior concrete slabs.

### 3.10 CONSTRUCTION TOLERANCE

- A. Exterior Site Improvements:
  - 1. Placement of all concrete shall not exceed 0.02 feet variance from designated grades.
  - 2. Surface variation of all concrete slabs shall not exceed 0.01 foot in 10 feet.
  - 3. Construction of all concrete subject to ADA access compliance, including Accessible Path of Travel, curb returns, parking stalls and unloading areas, barrier free amenities and

/ or other applicable site improvements shall conform to the Americans with Disabilities Act, California Title 24 and the California Building Code, regardless of any construction tolerances. Examples of minimum and maximum limits related to ADA access compliance include, but are not limited to:

- a. Accessible Path of Travel cross-slope shall not exceed 2 percent.
- b. Accessible Path of Travel longitudinal slopes shall not exceed 5 percent.
- c. Ramp longitudinal slopes shall not exceed 8.33 percent.
- d. Walks shall not have less than 48 inches in unobstructed width.

Maintain all grades and slopes throughout construction and until Notice of Completion has been filed.

**B. Building Slabs:**

1. General: All surface variations of slabs shall be less than 1/8 inch in 10 feet. Uniformly slope slab surfaces to drains where indicated on the drawings.
2. Typical Building Slabs:
  - a. Flatness: SOV, greater than FF 35, MLV, greater than FF 24.
  - b. Levelness: SOV, greater than FL 25, MLV, greater than FL 17.
3. Polished Concrete Flooring Slabs:
  - a. Flatness: SOV,; greater than FF 45, MLV,; greater than FF 30.
  - b. Levelness: SOV,; greater than FL 35, MLV,; greater than FL 24.
4. FF (Floor Flatness) and FL (Floor Levelness): The Contractor shall measure according to ASTM E 1155 "Standard test method for Determining FF (Floor Flatness) and FL (Floor Levelness) Numbers," within twenty-four (24) hours of the pour.
  - a. Cut down high spots, and fill low spots, and adjust pour techniques to achieve floor tolerances specified.
  - b. Contractor shall pay for and have a Certified Report in writing from an Independent Testing Agency that concrete substrates requiring FF and FL only are constructed to the specified tolerances, and are ready for floor coverings that require FF and FL.
  - c. SOV = Specified Overall Value.
  - d. MLV = Minimum Local Value.
  - e. Tolerances are required by the Polished Concrete Finishing Industry as an adequate substrate for their mechanized polishing machines to achieve any desired sheens on concrete surfaces.
  - f. Required tolerances of concrete surface substrates for specific flooring systems:
  - g. Polished Concrete: Refer to Specification Section - POLISHED CONCRETE FINISHING.

**3.11 REPAIR/RESTORATION**

**A. Minor Defects:**

1. Minor defects in concrete shall mean any of the following:
  - a. Pour joints, voids, rock pockets, tie holes, etc. where strength, and durability is not adversely affected.
  - b. Shrinkage Cracks where slabs are not exposed or where appearance is not important
  - c. Minor defects of pour joints, voids, rock pockets, tie holes, etc.
  - d. Immediately after removing forms, inspect all concrete surfaces. Patch any pour joints, voids, rock pockets, tie holes, etc., as soon as possible, but not until the defect has been examined by the Architect.
  - e. Chip away defective areas to a minimum depth of one inch, with edges perpendicular to surface. Clean area to be patched of all laitance.
  - f. Coat area to be patched with Bonding Agent. Patch with Mortar mixed with Bonding Agent thoroughly compacted into place and screeded off to leave the

patch slightly higher than the surrounding surface. After at least one hour finish patch to match the adjoining surface. Cure patch by application of curing compound or by wetting for seven (7) days.

- g. Fill tie holes solid with mortar after cleaning and thoroughly wetting. Fill through holes by means of a plunger-type grease gun. See Specification Section - CONCRETE FORMWORK, Part 3 Article titled "INSTALLATION," and the paragraph titled "Indentations" for exception.
  - h. Remove fins and rough surfaces from all exposed concrete.
2. Minor defect of shrinkage cracks:
- a. After entire slab is finished and fully cured, shrinkage cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.

B. Serious Defects:

- 1. Serious defects in concrete shall mean any of the following:
  - a. Concrete not meeting 100 percent of the specified 28 day compressive strength.
  - b. Concrete exhibiting rock pockets, voids, spalls, streaks, cracks, exposed reinforcing to extent that strength, durability, or appearance is adversely affected.
  - c. Concrete significantly out of place, line or level.
  - d. Concrete not containing the required embedded items.
  - e. Shrinkage Cracks where slabs are exposed and appearance is important.
  - f. Concrete where patching does not satisfactorily restore quality and appearance of surface.
- 2. Upon determination that concrete strength is defective:
  - a. Should cylinder tests fall below minimum strength specified, concrete mix for remainder of work shall be adjusted to produce required strength. Core samples shall be taken and tested from cast-in-place concrete where cylinders and samples indicate inferior concrete with less than minimum specified strength.
  - b. Cores of hardened concrete shall be taken and tested in accordance with ASTM C 39 "Test method for Compressive Strength of Cylindrical Concrete Specimens" and ASTM C 42 "Test method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete." Number and location of such cores shall be subject to the approval of Architect.
  - c. Cost of core sampling and testing will be paid for by the Contractor.
  - d. "500 psi" and "85 percent" reduction in ACI 318 "Building Code requirements for Structural Concrete and Commentary," Section 26.12.4 will not justify low cylinder tests.
  - e. If core tests indicate that concrete is below the strength specified, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.
- 3. Major defect of shrinkage cracks.
  - a. After entire slab is finished and fully cured, unsightly shrinkage cracks shall be repaired in a manner satisfactory in appearance to the Architect. If this cannot be accomplished, concrete shall be considered defective.
- 4. Upon determining that concrete surface is defective:
  - a. Contractor may restore concrete to acceptable condition by cutting, chipping, pointing, patching, grinding, if this can be done without significantly altering strength of structure.
  - b. Permission to patch defective areas will not be considered a waiver of the right to require removal if patching does not, in the opinion of the Architect, satisfactorily restore quality and appearance.
  - c. If patching does not restore concrete to specified quality and appearance, the concrete shall be deemed defective, and shall be removed and replaced without additional cost to the Owner.

- d. No repair work shall begin until concrete has been examined and procedures have been reviewed by the Architect and Structural Engineer and approved by [DSA][HCAI][AHJ].
- 5. Repair defects by complete removal of concrete and replacement or repair defects with Shotcrete in accordance with CBC Sections 1908A, strength to match mix design and material being repaired.
- 6. Place and cure Shotcrete in accordance with CBC Section 1908A.
- 7. Inspect and test Shotcrete as per CBC Section 1908A.10.
- C. Cost of repairing shall be borne by the Contractor.

### 3.12 FIELD QUALITY CONTROL

#### A. Contractor's Field Quality Control:

- 1. Contractor shall protect slabs receiving flooring products from excess moisture after the curing process, removing excess moisture after rains, broken water pipes, etc., to ensure that the monolithic slabs are dry enough for application of flooring products. When all spaces have been enclosed, acclimate the building as soon as possible with the building's own mechanical heating and cooling system, and other outside devices as required to properly prepare the monolithic slabs for flooring installation.
  - a. The test sites for the RH Tests shall be at the same room temperature and humidity expected during normal use. If this is not possible, then the test site conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent relative humidity) 48 hours prior to, and during testing.
- 2. Contractor shall maintain temperature and humidity in a manner not deleterious to the flooring materials installed until the Owner assumes occupancy.

#### B. Site Tests:

- 1. Compression Tests:
  - a. Testing Agent will make a set of four (4) concrete compression cylinders from each fifty (50) cubic yards or every 2,000 sq.ft. of surface area for slabs and walls per CBC Section 1905A.1.15 of each class of concrete, or fraction thereof, placed each day, and cure and test concrete compression cylinders in accordance with ASTM C 31 "Practice for Making and Curing Concrete Test Specimens in the Field," ASTM C 39 "Test method for Compressive Strength of Cylindrical Concrete Specimens," ACI Section 26.12 and ASTM C 172 "Practice for Sampling Freshly Mixed Concrete."
    - 1) From each concrete compression cylinder set, Testing Agent shall test one cylinder at age seven (7) days, test two cylinders at age twenty-eight (28) days per ACI 318 "Building Code requirements for Structural Concrete and Commentary," Section, 26.12 and hold one cylinder for test only if directed by the Architect.
    - 2) Cylinders shall be identified as to area from which they were taken and show the date and time of day they were prepared.
  - b. Testing Agent shall also test Grout and Mortar as required for compliance to Compression Requirements specified.
- 2. Drying Shrinkage Test (Lightweight Concrete Slabs only):
  - a. Testing agent will make three identical 4" x 4" x 11" specimens from the same concrete as used in the structure for the purposes of measuring Drying Shrinkage.
    - 1) Record time and location of concrete from which specimens were taken.
    - 2) Percent of shrinkage shall be reported at 21 days after 7 day moist curing period.
    - 3) Average results of 3 specimens shall be used as the accepted value.
    - 4) The value for laboratory cast specimens shall not exceed .040 percent.

- 5) If field test specimens are used in lieu of laboratory specimens, a tolerance of +33 percent may be used.

C. Inspection:

1. Project Inspector shall inspect placement of concrete and grout.

D. Manufacturer's Field Services:

1. Contractor shall notify Vapor Retarder manufacturer at least one week prior to the Pre-Construction Conference regarding the Vapor Retarder installation, and will schedule subsequent visits at the appropriate times with at least one week's notice to ensure proper installation of the Vapor Retarder in accordance with the Manufacturer's Written Instructions.
2. Manufacturer shall provide and written Inspection and installation certification to the Architect that full compliance with the manufacturer's written instructions were followed and adhered to prior to covering with concrete.

3.13 CLEANING

- A. The top of all concrete foundations receiving concrete masonry units shall be washed free of all laitance and loose concrete, and roughened to a roughness amplitude of 1/4".
- B. Remove all debris, excess materials, tools, and equipment resulting from or used in this operation at completion of work.

END OF SECTION

**SECTION 03 35 10 – POLISHED CONCRETE FINISHING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely provide polished concrete finishing materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 30 00 CAST-IN-PLACE CONCRETE
  - 5. 07 92 00 SEALANTS
  - 6. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 7. 09 68 40 CARPET
  - 8. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

**1.2 REFERENCES**

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ACI American Concrete Institute.
      - 1) ACI 302.1R "Guide for Concrete Floor and Slab Construction."
    - b. ASTM American Society of Testing Materials.
    - c. NFSI National Floor Safety Institute.
      - 1) NFSI Test Method 101-A "Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes."
    - d. RILEM Reunion Internationale des Laboratoires D'Essais et de Recherches sur les Matériaux et les Constructions.
      - 1) RILEM Test Method 11.4 "Standard Measurement of Reduction of Moisture Penetration Through Horizontal Concrete Surfaces."

**1.3 DEFINITIONS**

- A. New Concrete: Concrete poured as part of this Project. Refer to Specification Section - CAST-IN-PLACE CONCRETE.
- B. Existing Concrete: Any slab existing (or poured) prior to this Project.

**1.4 SYSTEM DESCRIPTION**

- A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete system. Any items not specifically noted but necessary for a complete system shall be provided under this section.

1. Fire Rating: Class "A" Fire Rated when tested in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials."
  2. Abrasion Resistance:
    - a. ASTM C 779 "Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces," Method A, high resistance, no more than 0.008 inch (0.20 mm) wear in 30 minutes.
  3. Reflectivity: Increase of 35 percent as determined by standard gloss meter.
    - a. ASTM E 430, "Standard Test Methods for measurement of Gloss or High-Gloss Surfaces by Abridged Goniophotometry."
  4. Waterproof Properties: RILEM Test Method 11.4, 70 percent or greater reduction in absorption.
  5. High Traction Rating after Polishing: NFSI 101-A, non-slip properties.
    - a. Static Coefficient of Friction: For Polished Concrete Floors, all walkway surfaces shall comply with the ADA Requirements and the following minimum values as determined by testing identical products per ASTM C 1028 "Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method:"
      - 1) Level Surfaces: Minimum 0.6.
      - 2) Ramps: Minimum 0.8.
- B. Design Requirements:
1. Verify Hardened Concrete Properties:
    - a. Minimum new concrete compressive strength Minimum 3,500 psi required.
    - b. Floor slab to be polished is Normal Weight Concrete.
      - 1) That no Lightweight Aggregate Concrete is used in the mix.
      - 2) That no Air Entrained Concrete Admixture is used in the mix.
  2. Verify Placement Properties:
    - a. That the natural concrete slump of concrete mix was between 4-1/2 inches – 5 inches.
    - b. Flatness and Levelness Requirements in accordance with ASTM E 1155 "Standard test method for Determining FF (Floor Flatness) and FL (Floor Levelness) Numbers:"
      - 1) Flatness: SOV, greater than FF 45, MLV, greater than FF 30.
      - 2) Levelness: SOV, greater than FL 35, MLV, greater than FL 24.
  3. Verify that the finish of the concrete slab was accomplished with Hard-Steel Trowels, and that the minimum passes for the slab was at least three (3) passes, and that there were no burn marks.
    - a. Finish shall comply with ACI 302.1R, Class 5 Floor.
  4. Verify that the Curing Options used for the floor slab were at least one of the following:
    - a. Sheet membrane (ASTM C 171 "Specification for Sheet materials for Curing Concrete").
      - 1) Polyethylene Film is NOT ALLOWED.
    - b. Damp Curing Process:
      - 1) Seven Day Cure minimum.
  5. Verify that no Spray-On "Cure and Seal" curing compounds were used.

## 1.5 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Product Data.

- a. Submit product data for specified products.
- b. Material Safety Data Sheets (MSDS).
- c. Standard Colored Concrete dyes or stains for selection by the Architect.
- d. Joint and Crack filler color range for selection by the Architect.
2. Shop Drawings.
  - a. Typical layout showing the colored concrete treatment areas per color choice.
  - b. Typical layout including dimensions and floor grinding schedule.
  - c. Plan view of floor and joint pattern layout.
3. Quality Assurance/Control Submittals:
  - a. Test Reports:
    - 1) Submit three (3) copies of reports.
      - a) Certified test reports showing compliance with specified performance characteristics and physical properties as cited in Design Requirements article.
      - b) Manufacturers Field Reports indicating that the manufacturer has read and instructed the installer of the proper procedures in regards to the Manufacturer's installation instructions prior to the start of the Polishing Operations.
      - c) Manufacturers Field Reports indicating Installers compliance with Manufacturer's Installation Instructions at the end of the Polishing Operations.
  - b. Certificates:
    - 1) Submit three (3) copies of certificates.
      - a) Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria, and physical requirements.
      - b) Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.
      - c) Current contractor's certificate signed by manufacturer declaring contractor as an approved installer of polishing system.
  - c. Manufacturer's Written Instructions:
    - 1) Submit three (3) copies of manufacturer's written procedural instructions.
4. Closeout Submittals in accordance with the following:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
  - c. Warranty in accordance with Specification Section - WARRANTIES.

## 1.6 QUALITY ASSURANCE

### A. Qualifications:

1. Installer Qualifications:
  - a. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
  - b. Installer trained and holding current manufacturer's certification for Polished Concrete Finish installation.



- 1) Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and data sheets.
    - 2) Use only manufacturer certified Polished Concrete Finishing installers.
    - 3) Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. Regulatory Requirements:
  1. In accordance with Specification Section - REGULATORY REQUIREMENTS.
- C. Mockups:
  1. Mock-Up Size: One 100 ft<sup>2</sup> sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
    - a. Mockups shall be located in a space that is not visible to the public, such as ancillary spaces, maintenance rooms, mechanical rooms, or rooms that will receive carpet. Refer to Finish Schedule.
    - b. Mockup grinding grades GGL II thru III for each color and finish for the Architect to select.
    - c. Show:
      - 1) Several intensities of colors for selection by Architect. More intense dye concentrations may be required to achieve color.
      - 2) Colors immediately adjacent to show workmanship in control of pattern.
      - 3) Partial sample of graphic at 100% scale.
      - 4) Partial sample of pattern: filled joints, colored, scored.
  2. Allow 24 hours for inspection of mock-up before proceeding with work.
  3. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, polished concrete shine, color, and proposed protection methods during construction.
    - a. Coordinate with Specification Section – CAST-IN-PLACE CONCRETE for Integral Color applications and color selections.
  4. Remove mock-up and dispose of materials when no longer required and when directed by the Architect.
- D. Meetings:
  1. New Concrete: Schedule prior to the concrete pour.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements, such as:
      - 1) Environmental requirements.
      - 2) Concrete mix requirements.
      - 3) Concrete curing requirements.
      - 4) Concrete protection requirements.
  2. Pre-Installation: Schedule prior to the start of work.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements, such as:

- 1) Environmental requirements.
  - 2) Scheduling and phasing of work.
  - 3) Coordinating with other work and personnel.
  - 4) Protection of adjacent surfaces.
  - 5) Surface preparation.
  - 6) Repair of defects and defective work prior to installation.
  - 7) Cleaning.
  - 8) Preparation and application of the Stains or Dyes to the floor areas in compliance with the floor coloring plan.
  - 9) Application of liquid hardener, densifier.
  - 10) Installation of polished floor finishes.
  - 11) Protection of finished surfaces after installation.
3. Progress: Scheduled by the Contractor during the performance of the work.
- a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
4. Completion: Scheduled by the Contractor upon proper completion of the work.
- a. Inspect and identify any problems, which may impede issuance of warranties or guaranties.
  - b. Maintaining installed work until the Final Inspection by the Architect.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from damage.
2. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
3. Delivery:
  - a. Deliver materials in manufacturer's original packaging with identification labels and seals intact.

B. Acceptance at Site:

1. Damaged products will not be accepted.
2. Products must be in manufacturer's original unopened containers with labels indicating brand name, product number, and grade.

C. Storage and protection:

1. Storage and Protection:
  - a. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
    - 1) Store under cover in a cool place with temperatures between 40 and 90 degrees F. Protect from freezing. Don't stack packages or buckets more than three high.
  - b. Protect concrete slab prior to stains, dyes, and polishing:
    - 1) Protect from petroleum stains during construction.
    - 2) Diaper hydraulic power equipment.
    - 3) Restrict vehicular parking.
    - 4) Restrict use of pipe cutting machinery.
    - 5) Restrict placement of reinforcing steel on slab.
    - 6) Restrict use of acids or acidic detergents on slab.
    - 7) Restrict use of adhesives on slab.

2. Waste Management and Disposal:
  - a. Remove from site and legally dispose of packaging materials.

## **1.8 PROJECT CONDITIONS**

- A. Environmental requirements:
  1. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles.
  2. Rain: The work under this section shall not be started or maintained under threat of rain unless the work is not affected by the rain.
  3. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
  4. Temporary Lighting: Provide a minimum 200W light source, placed 8 feet above floor surface, for each 425 sq ft of floor being finished.
  5. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.
  6. Verify that the concrete surface meets the Design Requirements within this specification.
- B. Existing Conditions:
  1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

## **1.9 SEQUENCING AND SCHEDULING**

- A. Sequence with Other Work: Comply with manufacturer's written recommendations for sequencing construction operations. It is imperative that this work be done before any framing is in place upon the slab, otherwise the consistency of the finish would be compromised if done at a later date within the construction operations.
  1. Grinding:
    - a. Identify the areas of existing or new slab construction, and coordinate the Grinding Grade Level required for each area.
  2. Integral Color and Polishing:
    - a. Provide integral color within the concrete mix at the time of pouring the slab, then allow a minimum of 28 days (but no more than 60 days) before the polishing operations begin.
  3. Dye and Polishing:
    - a. Provide dye operations in accordance with manufacturer's written instructions before the polishing operations begin.
  4. Stain and Polishing:
    - a. Provide stain operations in accordance with manufacturer's written instructions before the polishing operations begin.

## **1.10 WARRANTY**

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:

- a. Warranty Period: One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES
    - a. Warranty Period: One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified Polishing Concrete Finishing product manufacturer:
    - a. L & M CONSTRUCTION CHEMICALS: "PermaShine System."
    - b. Acceptable alternative manufacturers:
      - 1) ADVANCED FLOOR PRODUCTS: "RetroPlate 99."
      - 2) AMERIPOLISH
      - 3) DAYTON SUPERIOR: "Diamond Polish Floor Systems."
      - 4) DIAMATIC: "Ultraflor."
      - 5) THE BOMANITE CO.: "Manufacturer's Standard."
      - 6) PERFECT POLISH: "Natural Wonder Floor System."
      - 7) SCHOFIELD: "Formular One."
      - 8) W.R.MEADOWS: "Indurashine."
  - 2. Specified Concrete Dye product manufacturer:
    - a. L & M CONSTRUCTION CHEMICALS, INC.: "Vivid Concrete Dyes."
    - b. Acceptable alternative manufacturers:
      - 1) ADVANCED FLOOR PRODUCTS: "Manufacturer's Standard."
      - 2) AMERIPOLISH: "Manufacturer's Standard."
      - 3) DIAMATIC: "Manufacturer's Standard."
      - 4) DAYTON SUPERIOR: "Pro Aqua Vivid Dyes."
      - 5) THE BOMANITE CO.: "Pantene Teres Dyes."
      - 6) PERFECT POLISH: "Manufacturer's Standard."
      - 7) SCHOFIELD: "Formula One" Liquid Dye Concentrate.
  - 3. Specified Concrete Stain product manufacturer:
    - a. DAYTON SUPERIOR: "Pro Patina Stains."
    - b. Acceptable alternative manufacturers:
      - 1) ADVANCED FLOOR PRODUCTS: "Manufacturer's Standard."
      - 2) DIAMATIC: "Manufacturer's Standard."
      - 3) L & M CONSTRUCTION CHEMICALS: "Manufacturer's Standard."
      - 4) THE BOMANITE CO.: "Manufacturer's Standard."
      - 5) PERFECT POLISH: "Manufacturer's Standard."
  - 4. Specified Hardener / Densifier product manufacturer:
    - a. L & M CONSTRUCTION CHEMICALS, INC.: "FGS Hardener Plus."
      - 1) Acceptable alternative product manufacturers:
        - a) AMERIPOLISH "3D HS" & "SR2."

- b) THE BOMANITE CO.: "StabilizerPro."
    - c) THE BOMANITE CO.: "VitraFinish."
    - d) DYAMATIC: "Flor-Sil" Densifier and "Flor-Finish" Finish
    - e) W.R.MEADOWS: "Bellatrix" or "Liqui-Hard."
  - 5. Specified Oil Repellent Sealer product manufacturer:
    - a. L & M CONSTRUCTION CHEMICALS, INC.: "Petrotex."
      - 1) Acceptable alternative product manufacturers:
        - a) THE BOMANITE CO.: "VitraFinish."
  - 6. Specified Joint Filler product manufacturer:
    - a. L & M CONSTRUCTION CHEMICALS, INC.: "Joint Tite 750."
      - 1) Acceptable alternative product manufacturers:
        - a) EUCLID CHEMICAL: "Quick Joint 200."
  - 7. Specified Protective Cover product manufacturer:
    - a. RAM BOARD: "Ram Board."
      - 1) Acceptable alternative product manufacturers:
        - a) McTECH GROUP: "EZcover."
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Products:
- 1. Integral Color: See Specification Section – CAST-IN-PLACE CONCRETE.
  - 2. Water shall be potable.
  - 3. Concrete Dyes:
    - a. Provide fast-drying dye, packaged in premanufactured units ready for mixing with VOC Exempt Solvent, formulated for application to polished cementitious surfaces.
      - 1) Provide manufacturer's Standard Color Options for selection by Architect.
  - 4. Concrete Stains:
    - a. Water-Based, penetrating, reactive stains, that creates a chemical reaction within the concrete substrate, and formulated for application to polished concrete surfaces.
      - 1) Provide manufacturer's Standard Color Options for selection by Architect.
      - 2) No "Acid Etching Stains" allowed.
  - 5. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
  - 6. Hardener / Densifier: Water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
  - 7. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.

## 2.3 FINISHES

- A. Gloss Reading Standards, in accordance with ASTM E 430, "Standard Test Methods for measurement of Gloss or High-Gloss Surfaces by Abridged Goniophotometry".
- 1. GL-1 (Matte) 50 grit.
    - a. Gloss Reading: 2.

- b. Maximum Level of Slip Resistance (COF): 0.747.
    - c. Mohs Hardness Factor Range: 4.5.
  - 2. GL-2 (Matte) 120 grit.
    - a. Gloss Reading: 4.
    - b. Maximum Level of Slip Resistance (COF): 0.733.
      - c. Mohs Hardness Factor Range: 5.0.
  - 3. GL-3 (Matte) 220 grit.
    - a. Gloss Reading: 7.
    - b. Maximum Level of Slip Resistance (COF): 0.76.
      - c. Mohs Hardness Factor Range: 5.5.
  - 4. GL-4 (Low Sheen) 400 grit.
    - a. Gloss Reading: 23-25.
    - b. Maximum Level of Slip Resistance (COF): 0.803.
      - c. Mohs Hardness Factor Range: 7.0.
  - 5. GL-5 (Semi-Gloss) 800 grit.
    - a. Gloss Reading: 38-42.
    - b. Maximum Level of Slip Resistance (COF): 0.656.
      - c. Mohs Hardness Factor Range: 7.5.
  - 6. GL-6 (Semi-Gloss) 1800 grit.
    - a. Gloss Reading: 46-52.
    - b. Maximum Level of Slip Resistance (COF): 0.635.
      - c. Mohs Hardness Factor Range: 7.5.
- B. Verification of Performance:
  - 1. Ensure concrete finishing components and materials are from a single manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which, affect the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

#### **3.2 PREPARATION**

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
3. Determine the Grind Grade level related to the depth of cut, indicating the amount of aggregate that is to be revealed during the initial grinding of the surface:
  - a. GGL-I - Grind Grade Level I (Cream Finish):
    - 1) Grinding only the Portland Paste at the surface of the substrate without exposing small, medium or large aggregate.
  - b. GGL-II - Grind Grade Level II (Salt and Pepper Finish):
    - 1) Exposing the fine aggregate such as sand and small aggregate within the substrate. Generally, this level of grind can be achieved within 1/16 inch of the surface.
  - c. GGL-III - Grind Grade Level III (Medium Aggregate):
    - 1) Exposing more of the overall girth of the aggregate within the substrate. Generally, this level of grind can be achieved within 1/8 inch of the surface.
  - d. GGL-IV - Grind Grade Level IV (Large Aggregate):
    - 1) Exposing more of the overall girth of the aggregate within the substrate. Generally, this level of grind can be achieved within 1/4 inch of the surface.

### 3.3 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Provide planetary heads and orbiting machinery for a consistent and unburnished polishing effect.

#### B. Layout:

1. Lines shall be straight and true, except otherwise indicated.
2. In accordance with approved joints and floor pattern.

#### C. Assistance:

1. Application shall be in direct consultation and review of the manufacturer.

#### D. Floor Surface Polishing and Treatment:

1. Integral Color: See Specification Section – CAST-IN-PLACE CONCRETE.
2. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
3. Apply floor finish prior to installation of fixtures and accessories.
4. Dyed and Polished Concrete:
  - a. Locate demarcation line between dyed surfaces and other finishes.
  - b. Polish concrete to final finish level.
  - c. Apply selected diluted dyes to polished concrete surface in accordance with manufacturer's written recommendations.
  - d. Allow dye to dry.
  - e. Remove residue with dry buffer, reapply as necessary for desired result.
  - f. Score pattern lines from 1/16 inch to 1/8 inch deep between color changes.
5. Stained and Polished Concrete:

- a. Locate demarcation line between stained surfaces and other finishes.
  - b. Apply first coat of selected stain to concrete surface.
  - c. Allow stain to dry.
  - d. Apply second or third coat of selected stain (enough coats to match selected stain) to concrete surface.
  - e. Allow stain to dry.
  - f. Polish concrete to final finish level.
  - g. Remove residue with dry buffer, reapply as necessary for desired result.
  - h. Score pattern lines from 1/16 inch to 1/8 inch deep between color changes.
  6. Apply Hardener / Sealer / Densifier as follows:
    - a. First coat at 250 ft<sup>2</sup>/gal. (or per manufacturer's written recommendations).
    - b. Second coat at 350 ft<sup>2</sup>/gal. (or per manufacturer's written recommendations).
    - c. Follow manufacturer's recommendations for drying time between successive coats.
  7. Apply Oil Repellent Sealer as follows:
    - a. First coat per manufacturer's written recommendations.
    - b. Second coat per manufacturer's written recommendations.
    - c. Follow manufacturer's recommendations for drying time between successive coats.
  8. "Diamond" grit-polish concrete floor surfaces with planetary/rotary power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine diamond grit using dry method.
    - a. Comply with manufacturer's recommended diamond polishing grits for each sequence to achieve desired finish level. Level of sheen shall match that of approved mock-up.
    - b. Expose aggregate in concrete surface only as determined by approved mock-up.
    - c. All concrete surfaces shall be as uniform in appearance as possible.
  9. Grind & polish perimeter and edges to match field. Hand tools and multiple passes may be required to achieve uniform finish. Visible change in finish from field finish will not be accepted.
  10. Remove defects and re-polish defective areas.
  11. Finish edges of floor finish adjoining other materials in a clean and sharp manner.
- E. Burnishing
1. Utilizing a burnishing machine with 1,500 grit diamond impregnated pads, provide two (2) burnishings, requiring re-mobilization at the end of the project.
    - a. 1<sup>st</sup> Burnish            Upon completion of floor surface polishing and treatment.
    - b. 2<sup>nd</sup> Burnish            Just prior to occupancy / stocking / moving-in.

### 3.4 ADJUSTING

- A. Polish to higher gloss those areas not meeting specified gloss levels per mock-up.
- B. Fill joints greater than 1/8 inch deep flush to surface with color-matching material.
- C. Fill cracks greater than 1/8 inch deep flush to surface with color-matching material.

### 3.5 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  1. Leave area free of debris.
  2. Clean any soiled surfaces immediately.
  3. Finish shall be clean and ready for the application of any additional finishes.



**POLISHED CONCRETE  
FINISHING**

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4. In accordance with manufacturer's written instructions and recommendations.

**3.6 PROTECTION**

**A. Protection from traffic:**

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

**END OF SECTION**

## SECTION 05 12 00 – STEEL AND FABRICATIONS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Steel and Fabrications, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 15 14 DRILLED ANCHORS
  - 5. 03 20 00 REINFORCEMENT
  - 6. 03 30 00 CAST-IN-PLACE CONCRETE
  - 7. 06 41 23 MODULAR CASEWORK
  - 8. 07 21 00 INSULATION
  - 9. 07 40 00 METAL PANELS
  - 10. 07 60 00 SHEET METAL
  - 11. 07 72 00 ROOF ACCESSORIES
  - 12. 08 11 00 METAL DOORS AND FRAMES
  - 13. 08 41 00 STOREFRONTS
  - 14. 08 70 00 HARDWARE
  - 15. 09 91 00 PAINTING
  - 16. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 17. 10 11 00 VISUAL DISPLAY BOARDS
  - 18. 10 44 00 FIRE PROTECTION SPECIALTIES
  - 19. 11 66 43 SCOREBOARDS
  - 20. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 21. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with Specification Section – REGULATORY REQUIREMENTS and the following standards:
    - a. AISC: American Institute of Steel Construction "Specification for Design, Fabrication and Erection of Structural Steel buildings" and "Code of Standard Practice for Steel Buildings and Bridges" and "Recommended Procedure for Identification of High Strength Steels During Fabrication."
      - 1) NOTE: All connections shall be designed by the Structural Engineer and approved by DSA/SSS.
      - 2) NOTE: All connections shall be as shown in the Contract Document drawings.
      - 3) AISC: "Architecturally Exposed Structural Steel" 2016 AISC "Code of Buildings and Bridges," Section 10.

- 4) AISC: "Specification for Structural Steel Buildings" using the AISC 360-16.
- 5) AISC 341-16 Seismic Provisions.
- b. ANSI: American National Standards Institute:
  - 1) ANSI B18.22.1 "Plain Washers."
  - 2) ANSI B18.22.1 "Beveled Washers."
- c. ASTM: American Society for Testing and Materials.
  - 1) ASTM A 123: Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
  - 2) ASTM A 153: Standard Specification for Zinc (Hot-Dip) on Iron and Steel Hardware.
  - 3) ASTM A 385: Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
  - 4) ASTM A 780: Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- d. AWS: American Welding Society "Structural Welding Code."
  - 1) AWS D1.1 "Structural Welding Code."
  - 2) AWS D1.8 "Structural Welding Code - Seismic Supplement."
  - 3) AWS A2.4 "Standard Symbols for Welding, Brazing, and Nondestructive Examination."
- e. ICC: International Code Council
- f. NAAMM: National Association of Architectural Metal Manufacturers
  - 1) Metal Stairs Manual
  - 2) Pipe Rail Manual.
- g. RCSC: Research Council on Structural Connections, "Specification for Structural Joints Using High-Strength Bolts."
- h. SSPC: The Society for Protective Coatings.
  - 1) SSPC-SP 1 "Solvent Cleaning."
  - 2) SSPC-SP 2 "Hand Tool Cleaning."
  - 3) SSPC-SP 3 "Power Tool Cleaning."
  - 4) SSPC-SP 6 "Commercial Blast Cleaning."
  - 5) SSPC-SP 7 "Brush-Off Blast Cleaning."

### 1.3 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Welding Definitions:
  1. CVN Charpy V-Notch (Testing Procedure).
  2. FCAW Flux Core Arc Welding.
  3. FCAW-G Flux Core Arc Welding-Gas Shielded.
  4. FCAW-SS Flux Core Arc Welding-Self Shielded.
  5. G-MAW Gas Metal Arc Welding.
  6. SMAW Shielded Metal Arc Welding.

## 7. SAW Submerged Arc Welding.

## 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- B. Product Data.
  - a. Submit Load Indicating Device information as indicated in Part 3 of this Specification Section, and include Laboratory Test Reports and other data to show compliance with Specification (include Specified Standards).
  - b. Include certified copies of mill reports covering chemical and physical properties of each type of steel.
  - c. Submit primer paint system. Obtain certification from the project's Painting Contractor and Paint Manufacturer that primer paint system is compatible with proposed painting systems for this project.
- C. Shop Drawings.
  - 1. The Contract Drawings represent the spatial relationship as conceived by the Architect.
    - a. The production of the structural steel Shop Drawings may require the employment and utilization of a 3-dimensional structural steel fabrication layout program to achieve the exact relationship of all intersecting members.
    - b. Building sections and details represent interpretations of these relationships and the dimensions shown shall not be relied upon for accuracy and fit, but the Contractor / Structural Steel Fabricator shall verify them and double-check them for accuracy and fit.
    - c. Any significant variations shall be submitted to the Architect and Structural Engineer for review and approval, of which the conditions may or may not require DSA/SSS review and approval.
    - d. "Fit-Up" means and methods are the sole responsibility of the Contractor.
  - 2. Provide all information necessary for the fabrication of component parts. Indicate size and weight of members, type and location of shop and field connections, size and extent of all welds, and welding sequence when required.
  - 3. Include details of cuts, connections, camber, holes and other pertinent data. Include welds by Standard AWS Symbols, and show size, length and type of each weld.
  - 4. Provide sections, drawings, templates and directions for installation of anchor bolts and other anchors.
  - 5. Dimension requirements of structural steel for manufactured items, such as Mechanical Equipment, Dock Levelers, etc. All of these items shall be coordinated and provided by the General Contractor. The General Contractor shall also coordinate and provide dimensions to locate Structural Steel for Window Washing supports such as davits, tie-backs, etc.
- D. Shop Drawings for fabrication of AECS components.
  - 1. Identify AECS category for each steel member and connection, including transitions between AECS categories and between AECS and non-AECS.
  - 2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 3. Include embedment Drawings.
  - 4. Indicate orientation of mill marks and HSS seams.
  - 5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.

6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
  7. Indicate exposed surfaces and edges and surface preparation being used.
  8. Indicate special tolerances and erection requirements.
  9. Indicate weep holes for HSS and vent holes for galvanized HSS.
  10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.
- E. Samples.
1. Provide material samples cut and machined for testing without charge to the Owner.
- F. Quality Assurance/Control Submittals.
1. Test Reports:
    - a. Submit mill analysis and test reports for each heat, in accordance with ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use," certifying conformity with the Specifications. Steel shall be identifiable in the fabricating shop.
    - b. Submit test reports for each lot of high strength bolts in accordance with ASTM F 3125 "Standard Specification For High Strength Structural Bolts And Assemblies, Steel And Alloy Steel, Heat Treated, Inch Dimensions 120 Ksi And 150 Ksi Minimum Tensile Strength, And Metric Dimensions 830 MPa And 1040 MPa Minimum Tensile Strength" for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength."
    - c. Submit Welding Procedure Specification (WPS) to the Structural Engineer for review prior to use.
      - 1) For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted to the Structural Engineer for review prior to use.
    - d. Submit to the Structural Engineer for approval, a step by step welding sequence for the field welding of each type of connection.
    - e. Submit to the Structural Engineer a quality control plan that addresses all inspection issues, including in process and final inspection that are addressed in AWS D1.1.
  2. Certificates:
    - a. Submit current valid certificate issued by an independent testing agency for all welders, welding operators, and tack welders.
    - b. Certification of Welder's Qualifications: Welders that will make welds in restricted access, such as, but not limited to, the bottom flange-to-column welds through a cope hole or access hole in the beam web, shall be qualified by the Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
    - c. Provide Certified Mill Test Report Sheets in accordance with ASTM A123 "Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products," certified at the plant after galvanizing, but prior to shipment.
- G. Closeout Submittals:
1. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
  2. Warranty.

## 1.5 QUALITY ASSURANCE

## A. Qualifications:

## 1. Installer Qualifications:

- a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- b. Welders shall be recently qualified by Test as prescribed in AWS "Structural Welding Code" for the type of welding to be performed.
  - 1) All welders, welding operators, and tack welders shall be qualified with the largest diameter electrode(s) to be used on the work by test and hold a current valid certificate issued by an independent testing agency, to perform the type of welds required by the work; including the process, position, and thickness of materials used (AWS D1.1: Clauses 3 & 4 Sections).
  - 2) In addition to meeting the requirements of AWS, welders that will make welds with restricted access, such as, but not limited to, the flange to column welds through a cope hole or access hole in the beam web, or where access to the bottom of a groove is restricted by the presence of a column flange, shall be qualified by the Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.
  - 3) All welders on the project shall be capable of understanding and following the requirements of the written WPS.
  - 4) Each welder employed on the project shall understand all the requirements of this welding specification before welding on the project.
  - 5) The written WPS shall be available to the welder, welding supervisor, and all inspectors.
  - 6) Provide weld procedures for both pre-qualified welds and special welds to be submitted to the Owner's Testing laboratory and the Architect. Procedures shall be provided for both shop & field welds and shall be provided prior to commencing welding operations.

## 2. Manufacturer/Supplier Qualifications:

- a. Structural Steel firm experienced in successfully producing/supply capacity to produce/supply required units without causing delay in the Work.
- b. Provide documentation that the Hot-Dipped Galvanizer is a member in good association with the AGA (American Galvanizers Association).

## B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

## C. Mockups:

1. A typical mockup of welded connections shall be provided prior to shop fabrication.

## 1.6 DELIVERY, STORAGE, AND HANDLING

## A. Product Handling:

1. Store materials to permit easy access for inspection and identification. Keep steel members off the ground using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

## 1.7 SCHEDULING

- A. Schedule the Work so that there will be no excessive inspection time. At all times that an inspector is required, sufficient work shall be laid out and adequate personnel supplied so that the Inspector's time will be used to full advantage. If inspection costs become excessive because of poor shop procedure, such excess costs will be paid for by the Owner, but deducted from the Contract Price. Poor procedures will be determined upon review of Inspection and/or Testing Reports. The rate for charging the excess costs will be as follows:
1. Minimum of three (3) certified welders are used, Owner will pay 100 percent.
  2. Only two (2) certified welders are used, Contractor will be charged 1/3 of the Inspection cost.
  3. Only one (1) certified welder is used, the Contractor will be charged 2/3 of the inspection cost.

## 1.8 WARRANTY

- A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES
    - a. Warranty Period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 GENERAL

- A. The products listed establish size, pattern, color range and function selected by the Architect for this Project. Acceptable alternatives and substitutions must comply with the requirements of this project. If the acceptable alternatives or substitutions are not approved due to non-compliance with the contract documents, then the Contractor shall submit the specified product.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Steel:
1. Structural Shapes, Plates, and Bars: Shall be made in accordance with ASTM A 36, "Specifications for Carbon Structural Steel."
    - a. ASTM A 572, "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel," Grade 50.
    - b. ASTM A 992, "Standard Specification for Steel for Structural Shapes for use in Building Framing" Grade 50.
  2. Pipe: Shall be in accordance with "Specifications for Welded and Seamless Steel Pipe," ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," Grade B, or otherwise noted.

- a. Finish: Type E, for concealed conditions, Black, except where indicated on the drawings to be galvanized.
  - b. Finish: Type S, for visually exposed conditions, Black, except where indicated on the drawings to be galvanized.
- 3. Structural Tubes:
  - a. Cold-Formed tubing: Shall be in accordance with ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," Grade B.
  - b. Hot-Formed tubing: Shall be in accordance with ASTM A 501 "Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing."
  - c. All HSS sections (round and square) shall have their material certifications reviewed by the special inspector.
    - 1) The special inspector shall verify that all seam welds are fused in accordance with ASTM A 500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," Grade B.
    - 2) The special inspector shall, as a minimum, visually inspect the exterior of all seam welds.
- B. Light Gauge Cold Formed Shapes: In accordance with the following, unless otherwise noted on the Structural Engineer's Drawings:
  - 1. ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," such as "Zee" purlins, angles bent plated, etc.
  - 2. ASTM A 1011 "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability."
- C. Panels:
  - 1. Perforated Panels :
    - a. Manufacturer: DIAMOND PERFORATED METALS, INC.
    - b. Material: Stainless Steel, Type 304, 2B Finish.
    - c. Thickness: 16 Gauge.
    - d. Perforation: Hole: 0.562 inch, Centers: 1.191 inch, Open Area: 17.49%
    - e. Panel Ends and Edges: 1" margin at perimeter
- D. Plastic Steel Putty:
  - 1. Specified Plastic Steel Putty product manufacturer, or approved equivalent:
    - a. DEVCON Plastic Steel Putty A.

## 2.3 COMPONENTS

- A. Fasteners shall be in accordance with the following, unless otherwise noted on the Structural Engineer's Drawings:
- B. Anchor Bolts:
  - 1. All anchor bolts cast in concrete or masonry shall be headed bolts with cut threads conforming to:
    - a. ASTM F 1554 "Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength."



- C. Machine Bolts:
  - 1. ASTM A 307 "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."
- D. Stud-Type Shear Connectors: ASTM A 108 "Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality" Grade 1015 or 1020 Cold-finished carbon steel with dimensions complying with AISC Specifications.
- E. Power Driven Fasteners: Tempered steel pins with special corrosive resistant plating or coating. Pins shall have guide washers to accurately control penetration. Fastening shall be accomplished by low-velocity piston-driven power activated tool. Pins and tool shall be as manufactured by Hilti Fastening Systems.
- F. Filler Metal and Welding Flux in accordance with AWS D1.1 Clause 5 "Fabrication Section", and AISC 360, Section A3.5, and shall meet a CVN Impact Energy of 20 ft-lbs at minus 20 Degrees F.
  - 1. FCAW A5.20 or A5.29 E7XT-X.
  - 2. G-MAW A5.18 or A5.28 E70S-X.
  - 3. SAW A5.17 or A5.23 E7X-EXXX.
  - 4. SMAW A5.1 or A5.5 E70XX Low Carbon.

## 2.4 FABRICATION

- A. Shop Assembly:
  - 1. Fabricate in accordance with AISC Spec and AISC Code unless otherwise indicated on Drawings or Specifications.
    - a. Mechanically curve specific Structural members as indicated on the drawings in accordance with AISC requirements and tolerances.
  - 2. Fabricate all structural steel members and fittings.
  - 3. Fabricate all miscellaneous metal fabrications scheduled in Part 3 of this Specification Section.
  - 4. Architecturally Exposed Structural Steel and "Exposed to View" Metal Fabrications:
    - a. Comply with AISC - "Architecturally Exposed Structural Steel" 2010 AISC "Code of Buildings and Bridges," Section 10.
    - b. At all exposed joints, continuous fill with Plastic Steel Putty. Sand smooth and uniform and ready to receive finishes.
      - 1) Clean all areas to have smooth seams with manufacturers recommended cleaner.
      - 2) Place Steel Putty and cure.
    - c. Also, refer to drawings.
- B. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with the AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated to provide the flattest floor possible. The contractor shall coordinate member tolerances with finishes.
  - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
  - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
  - 3. Columns:

- a. All columns and beams shall adhere to Section M2.7 of the referenced "Specification for Structural Steel for Buildings" which states that completed members shall be free of twists, bends, and open joints.
- C. Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded connections or other connections are indicated.
- D. Unless noted otherwise, make holes 1/16 inches larger than the nominal bolt diameter.
  - 1. For anchor bolts, the hole diameter may not exceed the sizes indicated in CBC Section 2204A.4, nor what is specified on the drawings.
- E. Welding, Shop and Field: Weld by shielded arc method, submerged arc method, flux cored arc method, or other method approved by AWS. Perform welding in accordance with AWS Code. All welders, both manual and automatic, shall be certified in accordance with AWS "Standard Qualification Procedure" for the Work to be performed. See paragraph "welding" herein, for detailed requirements. If sizes of fillet welds are not shown on drawings, use AWS minimum weld size but not less than 3/16 inch fillet welds.
- F. Bolt Holes for Other Work: Provide holes required for securing other work to structural steel framing.
  - 1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
  - 2. Cut, drill or punch holes perpendicular to metal surfaces and remove all burrs. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- G. Welding - General:
  - 1. General: Quality of materials and design and fabrication of all welded connections shall conform to AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Building," AWS "Code for Welding in Building Construction," AWS "Structural Welding Code - Seismic Supplement," and requirements of this section.
    - a. Location and type of all welds shall be as shown. Make no other welded splices, except those shown on drawings, without prior approval of the architect.
  - 2. Automatic Welding: Use electrode wire and flux for automatic and semi-automatic welding acceptable to Architect. All methods, sequences, qualification and procedures, including preheating, and post heating if necessary, shall be detailed in writing and submitted to the architect for review.
  - 3. Qualification of Welders:
    - a. Structural steel welding: Manual and automatic welds for structural steel construction shall be made only by operators who have been previously qualified by tests, as prescribed in AWS D1.1 and D1.8 to perform type of work required.
    - b. Welders shall be checked by the welding inspector. Those not doing satisfactory work may be removed, and may be required to pass qualification tests again. All qualification testing shall be at the Contractor's expense.
    - c. Only welders whose weld procedures and pre-qualification by testing that have passed shall be considered qualified for such welds.
  - 4. Control cooling process after weld is completed by either step down post heat or thermal blankets as determined by procedures and prequalification.
  - 5. Box columns and built-up members shall have ultrasonic testing before and after welding.
  - 6. Flame cut surfaces shall be ground to remove contaminated steel layer to provide welds proper fusion without impurities.
  - 7. Preparation of surface: Surfaces to be welded shall be free of loose scale, slag, rust, grease, paint and any other foreign material.

8. Welding equipment: Welding equipment to be used in each case shall be acceptable to welding inspector. Use equipment with suitable devices to regulate speed and manually adjust operating amperage and voltage. The amperage capacity shall be sufficient to overcome line drop, and to give adequate welding heat.
9. Remove runoff tabs and grind surfaces smooth where the tabs would interfere with fireproofing and architectural finishes.
10. End-welded studs:
  - a. Automatic end-welded studs: Automatically end-weld in accordance with the manufacturer's written recommendations in such a manner as to provide complete fusion between the end of the stud and the plates. There shall be no porosity or evidence of lack of fusion between the welded end of the stud and the plate. The stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch, and 3/16 inch for 3/4 inch diameter. Stud sizes indicated on drawings represent the finish stud height.
  - b. Fillet-end welded studs: Studs may be welded using prequalified FCAW, GMAW, or SMAW processes provided the requirements of the AWS D1.1 Clause 7 "Stud Welding" are met as well as any other pertinent requirements of D1.1.
11. Provide mill camber as shown on the construction documents within AISC tolerance. Place mill tolerance upward for all beams specified no camber.

## 2.5 FABRICATION, AEES

- A. Shop fabricate and assemble AEES to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.
  1. Use special care handling and fabricating AEES before and after shop painting to minimize damage to shop finish.
- B. Architecturally Exposed Structural Steel, Category AEES 3:
  1. Comply with AISD Code standard tolerances.

## 2.6 FINISHES

- A. Shop Cleaning:
  1. Clean all surfaces of steel. Remove all rust, mill scale, deposits of splatter, slag or flux, oil, dirt, and all other materials.
    - a. Use hand tool, power tool, sandblasting, chemical cleaning, and any other method necessary to provide a smooth, sound surface.
  2. Clean contact surfaces of high strength bolt of all burrs and material, which might prevent solid seating of the parts. Steel to receive bolts shall be primer painted except beneath the contact area of slip-critical bolts.
- B. Shop Priming:
  1. General:
    - a. "Painting of structural steel shall comply with the requirements contained in AISC 360. Painting of open-web steel joist girders shall comply with the requirements of SJI CJ-1.0, SJI JG-1.1, SJI K-1.1 and SJI LH/DLH-1.1. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S200," per CBC Section 2203A.1.

- b. Shop prime all steel except the following:
  - 1) Surfaces embedded in concrete, or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2) Contact surfaces for slip-critical (sc) high strength bolts.
  - 3) Surfaces within 2 inches of field welds.
  - 4) Top of structural support members when metal deck is welded to supports.
    - a) Primer is required when metal deck is mechanically attached to structural support members.
  - 5) Surfaces to receive sprayed-fire-resistive materials (applied fireproofing).
  - 6) Surfaces to be galvanized.

2. Priming:

- a. Immediately after surface preparation, apply primer according to manufacturer's written instructions and at a rate recommended by SSPC to provide minimum film thickness. Use priming methods that results in full coverage of joints, corners, edges and exposed surfaces.
  - 1) Strip paint corners, crevices, bolts, welds and sharp edges.
  - 2) Apply two shop prime coats to areas, which will be inaccessible after assembly or erection.
- b. Provide PPG PAINTS field primers; or approved equivalent. Should the Contractor substitute another paint company other than "PPG PAINTS" in Specification Section - PAINTING, then coordination of steel primers with finish coats specified in Specification Section - PAINTING is the Contractor's responsibility.
- c. Use the following shop painting systems on all normal environment interior steelwork:
  - 1) Surface Preparation: SSPC-SP2 "Hand Tool Cleaning" or SSPC-SP3 "Power Tool Cleaning."
  - 2) Application: Follow coating manufacturer's printed directions.
  - 3) Material: PPG PAINTS MULTI-PRIME 94-258 Primer.
  - 4) Number of Coats: One.
  - 5) Dry Film Thickness: 2.0 mils minimum.
  - 6) Volume Solids: 51.0 +/- 1.0% minimum.
  - 7) Generic Description: Modified Alkyd Resin Universal Primer.
- d. Use the following shop painting systems on all exterior steelwork and interior steelwork subjected to wet conditions or fumes.
  - 1) Surface Preparation: SSPC-SP6 "Commercial Blast Cleaning."
  - 2) Application: Follow coating manufacturer's printed directions.
  - 3) Material: PPG PAINTS AMERCOAT 68HS Primer.
  - 4) Number of Coats: One.
  - 5) Dry Film Thickness: 5.0 mils minimum.
  - 6) Volume Solids: 78% +/-2%

## 7) Generic Description: Reinforced Inorganic Zinc-Rich Urethane.

## C. Hot-Dip Galvanizing:

1. Zinc coatings on iron and steel products in accordance with ASTM A 123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
  - a. Minimum thickness required shall be 3.9 mils.
2. Galvanize all items outside of the building envelope including, but not limited to structural steel columns and beams, railing systems, awnings, canopies, shade structures, etc., per ASTM A 385, "Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)."
3. Zinc coatings on iron and steel hardware shall be in accordance with ASTM A 153 "Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
4. Galvanized repair paint: High-Zinc-Dust-Content, in accordance with SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight paint for re-galvanizing welds and repair painting galvanized steel.

## D. Stainless Steel Finishes:

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish to produce uniform, directionally textured, polished surfaces without cross-scratches. Run grain with long dimension of each piece.
3. Bright Directional Satin Finish No.4, unless otherwise shown on drawings.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## 2.7 SOURCE QUALITY CONTROL

## A. Tests, Inspection:

1. In accordance with Specification Section – TESTING LABORATORY SERVICES and the following:
  - a. Materials shall be certified, identified and tested in conformance with CBC Table 1705A.2.1. Commercial stock steel shall be identified in accordance with CBC Table 1705A.2.1.
  - b. Complete four-sided inspection of all steel shall be made when required by Architect.
  - c. Tests and inspection of Shop and field welding in accordance with CBC Table 1705A.2.1. Perform shop and field welding only under supervision of welding inspector.
    - 1) Welds shall be in accordance with CBC Table 1705A.2.1.
    - 2) Inspection:
      - a) Welding inspector shall be an AWS Certified Welding Inspector (CWI).
  - d. Tests & Inspection for High Strength Bolts in accordance with CBC Table 1705A.2.1.
2. Testing Laboratory:
  - a. An inspection and testing laboratory will be selected by the Owner for testing and inspection as required by the Contract Documents. The selected laboratory shall conform to the requirements of ASTM E 329 "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction." Documentary evidence of such conformance shall be submitted to the Owner and the Governing Agency.

- b. All materials, work, methods and equipment shall be subject to inspection at the mill, fabricating plant and at the building site. Material or workmanship not complying fully with the Contract Documents will not be accepted. The Contractor shall give the Testing Laboratory reasonable notice when ready for inspection and shall supply samples and test pieces and all facilities for inspection without extra charge. The Owner will assume the expense of making the tests and inspection except as otherwise specified in Division 1.
- 3. Cost of Testing and Inspection: Costs of testing and inspection of structural steel, except as specified hereunder and in Division 1, will be paid for by the Owner.
  - a. All transportation costs and per diem living costs for inspection at fabricator's plant further than 75 miles from the job site will be back-charged to the Contractor.
  - b. It is assumed that all fabrication will take place in one shop location only. All additional inspection costs will be back-charged to the Contractor.
  - c. All mill tests and costs or re-test of plain materials shall be at the expense of the Contractor.
  - d. Costs of tests required due to Contractor's failure to provide steel identifiable in accordance with the indicated ASTM designation shall be at the expense of the Contractor.
- 4. Structural Steel Testing and Inspection:
  - a. If structural steel tests are indicated as required on the structural drawings, one tension and one bend test shall be made for each size of structural shape, plate and for each tube and pipe size. Tests to be made in accordance with requirements of appropriate ASTM designations.
  - b. If structural steel tests are not indicated as required on the structural drawings, then for shapes, plates, bars, pipe and tubing, manufacturer's certified mill test reports and analysis for each heat will be acceptable for steel identifiable in accordance with indicated ASTM designation. Mill test reports shall indicate the physical and chemical properties of all structural steel used. Correlate individual heat numbers with each specified structural section.
  - c. Unidentifiable Steel:
    - 1) For  $F_y$  less than or equal to 36.0 ksi: Provide one tension and elongation test and one bend for each 5 tons or fraction thereof for each size.
    - 2) For  $F_y$  greater than 36.0 ksi: Provide one tension and elongation test and one bend or flattening for each piece.
  - d. Costs of re-tests and additional testing required by the use of unidentifiable steels shall be the Contractor's responsibility. Additional costs of testing incurred by the Owner shall be deducted from the Contract Final Payment.
- 5. Expansion Anchors: Load test as indicated on the drawings.
- 6. Welding Inspection:
  - a. If shop or field welding inspection is indicated on the structural drawings, all shop and field welded operations shall be inspected by a qualified welding inspector employed by the Testing Laboratory. Such Inspector shall be a person trained and thoroughly experienced in inspection of welds. The inspector's ability to distinguish between sound and unsound welding will be reliably established.
  - b. The Welding Inspector shall make a systematic record of all welds. This record shall include:
    - 1) Identification marks of welders.
    - 2) List of defective welds.
    - 3) Manner of correction of defects.

- c. The welding inspector shall check the material, equipment and procedure, as well as the welds. He/she shall also check the ability of the welder. He/she shall furnish the Architect with a report, duly verified by him/her that the welding which is required to be inspected is proper, and has been done in conformity with the Contract Documents, and that he/she has used all means to determine the quality of the welds.
- d. All full penetration groove welds shall be subject to ultrasonic testing, as per AWS D1.1, Clause 6 "Inspection, Part "C", Ultrasonic Testing of Groove Welds." All defective welds shall be repaired and re-tested with ultrasonic equipment at the Contractor's expense.
- e. Column Flanges: An area extending 6 inches above and below point where girder flanges area attached shall be inspected. Column flange edges shall be inspected visually, and entire area ultrasonically for lamination, plate discontinuities, and non-metallic inclusions.
- f. All partial penetration groove welds shall be tested by ultrasonic testing.
- g. When ultrasonic indications arising from the weld root be interpreted as a defect, the Engineer shall be notified. The Engineer may require the removal of backing strip. The backing strip shall be removed at the expense of the Contractor, and if no root defects are visible the weld shall be re-tested. If no defect is indicated on this re-test, and no significant amount of base and weld metal have been removed, no further repair of welding is necessary. If a defect is indicated, it shall be repaired and re-tested at the Contractor's expense.
- h. The ultrasonic instrumentation will be calibrated by the technician to evaluate the quality of the welds in accordance with AWS D1.1.
- i. Other methods of inspection, for example, X-ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if felt necessary by the inspection laboratory, and with the approval of the Engineer.
- j. Base metal thicker than 1-1/2 inches, when subjected to through thickness weld shrinkage strains, shall be ultrasonically inspected for discontinuities directly behind such weld before and after joint completion.
- k. End-welded studs shall be sampled, tested, and inspected per the requirements of the Structural Welding Code – Steel D1.1, published by the American Welding Society.
- l. At the discretion of the Owner's testing agency, the ultrasonic testing frequency may be reduced but may not be less than the following:
  - 1) Initially, all welds requiring ultrasonic testing will be tested at the rate of 100 percent in order to establish the qualifications of each individual welder. If the reject rate is demonstrated to be less than 5 percent of the welds tested for each welder, then the frequency of testing for that welder may be reduced to 25 percent. If the reject rate increases to 5 percent or more, 100 percent testing will be re-established until the rate is reduced to less than 5 percent. The percentage of rejects will be calculated for each welder independently.
- m. A sampling of at least 40 completed welds will be made for such reduction evaluation. Reject rate is defined as the number of welds containing rejected defects divided by the number of welds completed. For evaluating the reject rate of continuous welds over 3' in length, each 12 linear inch increment of welds, 1 inch or less in thickness, will be considered as one weld. For evaluating the reject rate of continuous welds greater than 1 inch thickness, each 6 linear inches will be considered one weld.

**B. Verification of Performance:**

- 1. Testing Agent shall be a qualified person or Testing Laboratory listed and approved by DSA/SSS and selected by the Architect, and the Owner.

2. Testing Agent shall make Test and Inspection Reports certifying materials and workmanship to conform with Drawings and Specifications.
  - a. Cost of Testing and Inspection will be paid by Owner unless otherwise specified.
  - b. Cost of cutting and machining test samples shall be paid by Contractor.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

#### 3.3 ERECTION

- A. Employ a licensed land surveyor for accurate erection of structural steel.
  1. Check elevations of bearing surfaces (concrete or masonry), and locations of anchor bolts and similar devices, before erection work proceeds.
  2. Report discrepancies to Architect.
  3. Do not proceed with erection until corrections have been made or until compensating adjustments to structural steel work have been agreed upon with the Architect.
- B. Erect all Structural Steel frame work in accordance with AISC Specifications "Specification for the Design, Fabrication and Erection of Structural Steel for Building," latest edition, and AISC Code unless otherwise indicated on Drawings or Specification.
  1. Framing: Carry up framing true and plumb. Provide temporary bracing wherever necessary to support all loads to which the structure may be subjected, including erection equipment and its operation. Leave bracing in place as long as may be required for safety. As erection progresses securely connect the work to take care of all dead load, wind and erection stresses.
  2. Connections:
    - a. Machine Bolts shall be installed with cut washer under nut.
    - b. Welding: The details of all joints, the technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work shall conform to "AISC Specs," "AWS Code," Table 1705A.2.1.
      - 1) All "exposed-to-view" welds will be smooth and flush with no voids showing and still be in conformance with standards referenced herein.



- 2) All exposed to view butt welds shall be flush as connected members will allow. Minor defects and transitions in metal surfaces shall be filled and sanded out with an approved metal filler prior to painting.
  - 3) Exposed fillet welds are acceptable "as is" provided the surface chevrons are shallow and have no abrupt protrusions.
3. Cutting Holes: The use of a cutting torch is permissible only if the metal being cut is not carrying stress during the operation and only with the prior approval of the Architect and DSA/SSS for each specific condition.
  4. Setting Plates: Set column base plates and leveling plates to correct elevations and temporarily support on steel wedges or shims until the supported members have been plumbed, locked in place and grouted.
- C. Erection Sequence: Erect steel in accordance with special erection sequences where special erection sequences are indicated on the contract documents.
  - D. Before and during erection, keep all structural steel clean. Ship, handle and store steel in a manner to avoid injury to members. Steel members showing evidence to rough handling or injury will be rejected.
  - E. Mark each member with erection identification corresponding to mark shown on erection drawings. Carefully plan erection of structural steel so that no cutting and removal of material will be necessary. Do not torch burn in the field, unless specifically permitted by Engineer.
  - F. Provide sufficient bracing, shoring and guys to effect safe and satisfactory erection. Provide bracing and shoring capable of holding steel work plumb and properly aligned while field connections are being made, and until lateral force resisting elements are deemed by the Architect to be capable of bracing structure. Temporary bracing shall be adequate to resist lateral forces from wind or seismic prior to the completion of the lateral resisting system.
  - G. Set bearing and base plates with extreme care. Bring level, to line and grade with leveling plates or by leveling nuts and bolts. Grout solid under plates with a flowable non-shrink grout per Specification Section – CAST-IN-PLACE CONCRETE prior to applying vertical load.
  - H. Field Assembly: Set structural framing accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces which will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
    1. Shimming or other adjustments not indicated on drawings shall be approved by the Engineer prior to installation. Level and plumb individual members of the structure within specified AISC tolerances except as noted herein. Column shimming shall be 1/4 inch.
  - I. All welds shall be full and clean, and conform to AISC and AWS Specifications.
  - J. Erection Tolerances: Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
    1. Individual pieces shall be erected so that the deviation from plumb, level and alignment shall not exceed 1 to 500 plus:
    2. The maximum displacement of the center-line of columns adjacent to elevator shafts, from the established column line, shall not be more than 1 inch at any point from the established column line in the first 20 stories.
    3. In order to provide a true, flat plane for the exterior elevations, install all steel framing at the exterior walls of the building, so that the center lines of such framing does not vary by more than 1 inch for the length of the building.

- a. Also, install each vertical member on such grids so that its vertical center-line does not vary by more than 1/2 inch from a vertical line for each story and 1 inch for its full height.
  4. Take special care that column base plates are parallel and perpendicular to faces of columns and that bolt holes are accurately placed.
- K. Hoisting And Bracing:
1. Provide all hoisting and erecting equipment and power.
  2. Provide and maintain any and all safety railings, toe boards, etc., required for the erection of steel framing and metal decking.
  3. Brace the erected frame in a manner which will assure safety and proper alignment to receive the metal decking and until the concrete slabs have been poured and have set.
  4. Erect building frame true and level. Erect columns in a manner to allow for movement due to welding shrinkage and thermal expansion and contraction of framing. Check for plumb after erection of each level. Maintain structural stability of frame during erection. Provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.

### 3.4 ERECTION OF AEES

- A. Take special care during erection to avoid marking or distorting the AEES and to minimize damage to shop painting. Set AEES accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
  2. Grind tack welds smooth.
  3. Remove backing and runoff tabs, and grind welds smooth.
  4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  5. Remove erection bolts in Category AEES 4 AEES, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
  6. Fill weld access holes in Category AEES 4 AEES with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
  7. Conceal fabrication and erection markings from view in the completed structure.

**B** In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.

1. Erection of Category AEES 4:
  - a. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
  - b. Remove weld spatter, slivers, and similar surface discontinuities.
  - c. Grind off butt and plug weld projections larger than 1/16 inch (1.6 mm).
  - d. Continuous welds are to be of uniform size and profile.
  - e. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
  - f. Splice members only where indicated on Drawings.
  - g. No torch cutting or field fabrication is permitted.
2. Erect AEES to the standard frame tolerances specified in ANSI/AISC 303 for non-AEES.

- h. Weld profiles, quality, and finish are to be as approved by Architect.
- i. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
- j. Grind welds smooth.
- k. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
- l. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

### 3.5 REPAIR / RESTORATION

- A. Defective Work shall be immediately replaced with proper work. Such replaced Work and the Testing and Inspection for it shall be at the expense of the Contractor. If defects or damages cannot be corrected in the field, the material shall be returned to the shop or new parts furnished, as the Architect directs, and the Contractor shall pay all costs therefor.
  - 1. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780 "Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings."
  - 2. Primer Coat - On all hot-dip iron or steel that needs repair, provide one primer coat of the following:
    - a. Zinc Rich Galvanize No. 1141 by AERVOE INDUSTRIES, INC., or approved equivalent.
    - b. Provide a smooth-flowing, high-solids compound that provides a fast-drying coating that protects ferrous metals in highly corrosive environments. Coating shall be 97% pure zinc metallic flake, which leaves 94% zinc in the dry film.
    - c. Overall Dry Film Thickness: 2.0 mil.
  - 3. Finish Coat - On all hot-dip iron or steel that needs repair, provide one finish coat over a properly cured primer coat of the following:
    - a. Zinc Rich Galvanize No. 1141 by AERVOE INDUSTRIES, INC., or approved equivalent.
    - b. Provide a smooth-flowing, high-solids compound that provides a fast-drying coating that protects ferrous metals in highly corrosive environments. Coating shall be 97% pure zinc metallic flake, which leaves 94% zinc in the dry film.
    - c. Overall Dry Film Thickness: 2.0 mil.
- B. Touch-up Primer Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop priming to comply with SSPC-PA1 "Touching Up Shop-Painted Surfaces."
  - 1. Clean and prepare surfaces by SSPC-SP 2 "Hand-Tool Cleaning" or SSPC-SP 3 "Power-Tool Cleaning."

### 3.6 FIELD QUALITY CONTROL

- A. Site Tests:
  - 1. As required by Regulatory Requirements.
- B. Tests, inspection:
  - 1. As required by Regulatory Requirements.
  - 2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
  - 3. No work shall be without the inspections required by Regulatory Requirements.

4. Tests and inspection of field welding in accordance with CBC Table 1705A.2.1. Perform field welding only under supervision of welding inspector.
  - a. Welds shall be in accordance with CBC Table 1705A.2.1.
  - b. Inspection shall be in accordance with CBC Table 1705A.2.1.
    - 1) Welding inspector shall be an AWS Certified Welding Inspector (CWI).
- C. Verification of Performance:
  1. Certification:
    - a. The Contractor shall engage and pay for a registered Civil Engineer or Licensed Land Surveyor to check the alignment, plumbness, elevation, and overall accuracy of the erected framing at appropriate stages during construction and at completion of erection.
    - b. Civil Engineer or Licensed Land Surveyor shall submit written verification and certification that the entire installation is in accordance with the Contract Documents.

### 3.7 SCHEDULES

- A. Metal Fabrication Schedule should be used as a guide only and is not considered as a complete list. Refer to Drawings for location and details:
  1. Miscellaneous backing members, brackets, and supports for work installed by other trades.
  2. Ladder
  3. Canopy
  4. Down Spouts

END OF SECTION

## SECTION 061000 – ROUGH CARPENTRY

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide all material, labor, equipment and services necessary to complete all rough carpentry, accessories and other related items necessary to complete the Project as indicated by the Construction Documents unless specifically excluded.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 15 14 DRILLED ANCHORS
  - 5. 03 30 00 CAST-IN-PLACE CONCRETE
  - 6. 05 12 00 STEEL AND FABRICATIONS
  - 7. 06 17 33 WOOD JOISTS
  - 8. 06 18 00 GLUE-LAMINATED CONSTRUCTION
  - 9. 06 22 00 MILLWORK
  - 10. 06 41 23 MODULAR CASEWORK
  - 11. 07 21 00 INSULATION
  - 12. 07 40 00 METAL PANELS
  - 13. 07 51 13 BUILT-UP ROOFING
  - 14. 07 60 00 SHEET METAL
  - 15. 07 72 00 ROOF ACCESSORIES
  - 16. 07 92 00 SEALANTS
  - 17. 08 11 00 METAL DOORS AND FRAMES
  - 18. 08 31 13 ACCESS DOORS AND FRAMES
  - 19. 08 41 00 STOREFRONTS
  - 20. 08 70 00 HARDWARE
  - 21. 09 24 00 CEMENT PLASTER
  - 22. 09 29 00 GYPSUM BOARD
  - 23. 09 30 00 TILE
  - 24. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 25. 09 68 40 CARPET
  - 26. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 27. 10 11 00 VISUAL DISPLAY BOARDS
  - 28. 10 14 00 IDENTIFYING DEVICES
  - 29. 10 21 13 TOILET PARTITIONS
  - 30. 10 28 13 TOILET ACCESSORIES
  - 31. 10 44 00 FIRE PROTECTION SPECIALTIES
  - 32. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. ALSC American Lumber Standards Committee
  - 2. ANSI American National Standards Institute
  - 3. APA The Engineered Wood Association (Formerly the American Plywood Association)
  - 4. ASME American Society of Mechanical Engineers International
  - 5. AWWPA American Wood Protection Association
  - 6. CABO Council of American Building Officials

- 7. FS Federal Specification
- 8. ICC International Code Council
- 9. NDS National Design Specification for Wood Construction
- 10. NIST National Institute of Standards and Technology
- 11. PS Product Standards of the U.S. Department of Commerce
- 12. RIS Redwood Inspection Service
- 13. WCLIB West Coast Lumber Inspection Bureau
- 14. WWPA Western Wood Products Association

**1.3 SUBMITTALS**

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- B. Product Data:
  - 1. Submit manufacturer's data for Wood-Preservative Treatment.
  - 2. Submit manufacturer's data for Fire-Retardant Treatment.
  - 3. Submit manufacturer's data for power driven fasteners, metal-framing connectors, and metal framing anchors.
- C. Quality Assurance/Control Submittals:
  - 1. Material Certificates: Submit Material Certificates of Compliance to Standards and Regulatory Requirements.

**1.4 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
- C. Meetings:
  - 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
    - b. Maintaining installed work until the Notice of Substantial Completion has been executed.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver undamaged products to project site in manufacturer's sealed containers or bundles with tags and labels intact.
- B. Storage and Protection:

1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
2. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

**1.6 PROJECT CONDITIONS**

**A. Environmental Requirements:**

1. Dust Control: Perform work in a manner as to minimize the spread of dust and flying particles.
2. Burning: No burning will be allowed on-site.
3. Rain: Work under this section shall not be started or maintained under threat of rain unless the work is not affected by the rain.

**B. Existing Conditions:**

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

**1.7 WARRANTY**

**A. Contractor's General Warranty:**

1. In accordance with Specification Section - WARRANTIES.

**B. Manufacturer's Warranty: 1 Year.**

1. In accordance with manufacturer's written standard warranty.

**C. Installer's Warranty: 1 Year.**

1. In accordance with the terms of the Specification Section - WARRANTIES

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A.** These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Power Driven Fastener specified product manufacturer:
  - a. HILTI FASTENING SYSTEMS.
2. Metal Framing Anchor specified product manufacturer:
  - a. SIMPSON STRONG-TIE COMPANY.
  - b. Acceptable alternative manufacturers:
    - 1) Manufacturers of Alternative Metal Framing Anchors shall have Model Code Research Evaluation Reports and Published allowable design loads that are determined from empirical data, or by rational engineering analysis, that are demonstrated by comprehensive testing performed by a qualified testing agency acceptable by the Architect or its Designated Design Consultant, and DSA.
3. Metal Timber Framing Connector specified product manufacturer:
  - a. SIMPSON STRONG-TIE COMPANY.
  - b. Acceptable alternative manufacturers:

- 1) Do not substitute connectors manufactured by others than SIMPSON STRONG-TIE COMPANY without prior written review by the Architect or its Designated Design Consultant, and DSA.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 WOOD

### A. Douglas Fir - Larch:

1. Standards and Requirements: In accordance with WCLIB "Standard Grading and Dressing Rules" No. 17, latest edition, and WWP A "Western Lumber Grading Rules," latest edition.
  - a. All wood shall be "DRY" and having a moisture content of less than 19 percent at the time of installation, in accordance with WWP A.
  - b. Provide wood of S4S unless otherwise noted.
  - c. Factory mark each piece of wood with the grade stamp of the grading agency.
2. Grading and Use Requirements:

Item	Sizes	Grade	Maximum Moisture Content at Initial Use (Installation)
Studs	2x	No. 1	19%
Studs	3x, 4x, 6x	No. 1	19%
Sills & Plates	2x	No. 1	19%
Sills & Plates	3x, 4x, 6x	No. 1	19%
Beams	4x, 6x	No. 1	19%
Joists	2x	No. 1	19%
Posts	4x, 6x, 8x	No. 1	19%
Ledgers	2x	No. 1	19%
Ledgers	3x, 4x, 6x	No. 1	19%
Blocking	2x, 3x, 4x, 6x	No. 1	19%
Sheathing and Stripping	Up to 1-1/2" thick 2" width and wider	No. 1	19%
Stripping	2x, 3x, 4x, 6x	Construction	19%
Nailers & Grounds	2x, 3x, 4x, 6x	Construction	19%
Furring	2x, 3x, 4x, 6x	Construction	19%
T & G Decking	2x	Select Dex	15%

- a. Initial use shall be that point at which screws or other fasteners or the holes for said fasteners are installed into the wood.
- b. The Contractor shall use whatever means necessary, including site drying to ensure that the moisture contents listed above are not exceeded.

## 2.3 PLYWOOD

### A. Soft Plywood:

1. Standards and Requirements: In accordance with PS1-19, Group 1 Douglas-Fir and PS2-18.
  - a. Factory mark each piece of plywood with the APA Grade Stamp.
  - b. Maximum Moisture Content at Initial Use (Installation) shall be 15 percent.
2. Grading and Use Requirements:
  - a. Wall, Roof, and Parapet Sheathing:
    - 1) APA Rated Sheathing - Structural 1.
    - 2) Span Rating as required to suit stud or joist spacing.
    - 3) Exposure Durability Classification - Exposure 1.

Update to currently adopted standards per CBC Chapter 35



- 4) Species Group 1.
- 5) Grade C-C 3 ply for 1/4 inch thickness and C-D 5 ply for 1/2 and 5/8 inch thickness.
- b. Subflooring, Floor Sheathing as underlayment, Equipment Platform Sheathing:
  - 1) APA Rated "Sturdi-Floor."
  - 2) Span Rating as required to suit joist spacing.
  - 3) Exposure Durability Classification - Exposure 1.
  - 4) Species Group 1.
  - 5) Grade C-C plugged.
- c. Backing panels for Electrical Equipment.
  - 1) APA Rated Sheathing - Structural 2.
  - 2) Exposure Durability Classification - Exterior.
  - 3) Species Group 1.
  - 4) Grade C-C.
  - 5) Shall be 3/4 inch minimum thickness.
- d. Backing panels for Telecommunication Equipment:
  - 1) APA Rated Sheathing - Structural 2.
  - 2) Exposure Durability Classification - Exterior.
  - 3) Species Group 1.
  - 4) Grade A-B.
  - 5) Shall be 3/4 inch minimum thickness.

## 2.4 PRESERVATIVE TREATMENT

- A. Pressure Process: AWP A U1:
- B. Preservative Chemicals: Per AWP A U1 Section 4 Table 1 Preservatives for Pressure Treatment processes, Waterborne, Alkali-based (amine/ammonia), acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX).
- C. Redry boards after treatment to 19 percent maximum moisture content.
- D. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- E. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- F. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
- G. Field cut treatment: copper naphthenate.

## 2.5 FIRE RETARDANT TREATMENT

- A. Fire Retardant Treat Wood and Plywood with pressure treatment materials that comply with performance requirements of CBC 2303.2.
  - 1. Use Exterior Type.
  - 2. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures when tested by a qualified independent testing agency and is acceptable to Fire and Life Safety authorities.
  - 3. Use treatment that does not promote corrosion of metal fasteners.
  - 4. After treatment, kiln-dry wood to a maximum moisture content of 19 percent.
  - 5. After treatment, dry plywood to a maximum moisture content of 15 percent.

6. Factory mark each treated item with the treatment quality mark of an Independent Inspection Agency.

## 2.6 ACCESSORIES

- A. Fasteners: All types shall comply with standards and dimensions of the latest edition of NDS. All types of fasteners exposed to wet or exterior conditions, in-ground contact, in pressure or preservative treated woods, in concrete or masonry, or in an area of high relative humidity shall be hot-dipped galvanized in accordance with ASTM A 153 "Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware."
  1. Nails: Common wire nails or spikes complying with ASTM F 1667 "Specification for Driven Fasteners: Nails, Spikes, and Staples," and CBC Section 2304.10. Box nails and sinker nails are not permitted. Vinyl coating is permitted on common nails.
  2. Bolts: Steel bolts complying with ASTM A 307 "Specification for Carbon Steel Bolts and Standards, 60,000 PSI Tensile Strength," Grade A, hex head.
    - a. Provide hex head nuts complying with ASTM A 307 "Specification for Carbon Steel Bolts and Standards, 60,000 PSI Tensile Strength," and standard flat washers complying with ANSI/ASME B18.22.1, Type A, Wide pattern.
  3. Lag Bolts: Shall comply with ANSI/ASME B18.2.1, hex head.
    - a. Provide standard flat washers complying with ANSI/ASME B18.22.1, Type A, Wide pattern.
  4. Wood Screws: Shall comply with ANSI/ASME B18.6.1.
    - a. Screws for fastening wood to Metal Framing shall comply with ASTM C 954 "Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness."
  5. Power Driven Fasteners: Tempered Steel pins with corrosive resistant plating or coating complying with ICC ESR-1539.
- B. Metal Framing Anchors: All anchors shall comply with ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," G60 Coating Designation for hot-dipped zinc-coated steel sheet. Provide structural, commercial, or lock-forming quality as standard with manufacturer for type of anchor indicated.
- C. Metal Timber Framing Connectors: All connectors shall have specific ICC Approval and be fabricated from hot-dipped galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
  2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  3. Execution of work under this specification section shall constitute acceptance of existing conditions.
  4. Verify that work under this Section may be performed in strict accordance with the original design and all pertinent codes and regulations.

### 3.2 PREPARATION

- A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  1. Protect all materials from damage occurring from work called for under this specification section.
- C. Preservative Treatment:
  1. Members requiring pressure treatment:
    - a. Sills, Plates, Ledgers, Studs, Joists, Blocking, Nailers and Furring attached or resting on or against concrete or masonry construction.
    - b. Pressure treated members cut in the field shall have the cut ends painted with preservative until the wood or plywood absorbs no more preservative.
  2. Members requiring field treatment:
    - a. All wood and plywood members at exterior walls within two feet of the ground surface.
    - b. Treat all surfaces of the member.
    - c. Treat by dipping the required portion of the member into preservative for 15 minutes or paint until the wood or plywood absorbs no more preservative. Wait a minimum of two hours after dipping or painting is complete to incorporate member into project.
    - d. Test treat items for compatibility where additional finish coats (stain or paint) may occur.
- D. Fire Retardant Treatment:
  1. All wood and plywood members as indicated.
  2. All plywood panels for Telecommunication Equipment.

### 3.3 INSTALLATION

- A. General:
  1. In accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
  2. In accordance with approved submittals.
  3. In accordance with Regulatory Requirements.
  4. Selection of wood and plywood pieces:
    - a. Carefully select all members.
    - b. Select individual pieces so that knots and obvious defects will not interfere with placing bolts, proper nailing, and making proper connections.
    - c. Cut out and discard all defects which will render a piece unable to serve its intended function.
    - d. Wood and plywood may be rejected by the Architect or its Designated Design Consultant, and DSA whether or not it has been installed for excessive warp, twist, bow, crook, mildew, fungus, or mold as well as for improper cutting, fitting and treatment when required.
  5. All wood and plywood shall be accurately cut to lengths required.
  6. All work shall produce joints true, tight, level, plumb, and all members are securely anchored.
    - a. Do not shim any framing member.
  7. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- B. Layout:
  1. Lines shall be straight and true.
- C. Fastening:
  1. Nails:
    - a. All nailing shall be as required by CBC Table 2304.10.2 "Fastening Schedule."

- b. Machine nailing may be approved subject to the approval of the Architect or its Designated Design Consultant, and DSA.
  - 1) The use of machine nailing is subject to a satisfactory job site demonstration for each project. The approval is subject to continued satisfactory performance.
  - 2) In plywood, if the nail heads penetrate beyond flush with the surface of the sheathing, or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory.
  - 3) Machine nailing will not be accepted in 5/16" plywood.
- c. Penetration of nails or spikes shall be one-half the length of the nail or spike into the piece receiving the point.
- d. 16d nails shall be used to connect pieces 2" in thickness unless otherwise indicated.
- e. Clinch nails protruding through members.
- f. Bore holes for nails where necessary to prevent splitting.
- g. Use Finish or Casing Nails for finish work.
- 2. Lag Bolts:
  - a. Lag Bolts shall be screwed into place. No driving is allowed.
  - b. For the Shank portion, holes shall be bored the same depth and diameter as the shank. For threaded portion, holes shall be between 60% and 75% of the shank diameter.
  - c. Malleable Iron or Steel plate washers shall be used where bolt heads bear on wood or plywood. Washers shall have an area equal to 16 times the area of the bolt.
    - 1) Steel plate washers shall have a thickness not less than 1/10 the length of the washer's longest side.
    - 2) Malleable Iron washers shall have a bearing surface for the head equal in diameter to not less than the long diameter of the head.
  - d. Tighten all bolts and screws prior to concealing within structure.
- 3. Bolts:
  - a. Holes shall be 1/16" larger than bolt diameter.
  - b. Malleable Iron or Steel plate washers shall be used where bolt head and nuts bear on wood or plywood. Washers shall have an area equal to 16 times the area of the bolt.
    - 1) Steel plate washers shall have a thickness not less than 1/10 the length of the washer's longest side.
    - 2) Malleable Iron washers shall have a bearing surface for the head or nut equal in diameter to not less than the long diameter of the head or nut.
  - c. Tighten all bolts prior to concealing within structure.
- 4. Power Driven Anchors
  - a. Fastening shall be accomplished by low-velocity piston-driven power activated tool.
  - b. Pins shall have guide washers to accurately control penetration.
- 5. Expansion Anchors (Post-Installed Concrete Anchors):
  - a. Refer to Specification Section - DRILLED ANCHORS.
- 6. Metal Framing Anchors
  - a. Use half-length nails where required or indicated.
- 7. Metal Timber Framing Connectors
  - a. Nailing shall conform to manufacturer's instructions with a nail provided for each punched hole.
- D. Sills:
  - 1. Shall be in long lengths of sizes as indicated.
  - 2. Fasten with a minimum of two (2) anchor bolts per piece and bolt within 9", but not nearer than 6", from the end of piece.
  - 3. Malleable iron or steel plate washers shall be placed under anchor bolt nuts bearing on wood.

4. Set Sill level and true.
- E. Studs and Posts:
  - a. Shall be full length.
2. Cut members to provide full bearing at ends.
- F. Plates:
  1. Shall be in long lengths and spliced as indicated.
- G. Joists and Beams:
  1. Shall be in long lengths and spliced over bearings unless otherwise indicated. Do not overcut.
  2. Install with crown side up.
  3. Beams or headers indicated to be built-up of two or more joists shall be constructed on the project site using full length members.
- H. Blocking:
  1. Blocking shall be same thickness and width of studs or joists unless otherwise indicated.
  2. Install blocking at all wall, floor, or roof penetrations.
    - a. Blocking shall provide surface for fastening applied interior or exterior flashings or flanges.
  3. Install blocking at all plywood joints.
    - a. Install blocking at plywood edges including crickets and parapet wall bracing.
  4. Shall be provided for all fixtures, equipment, casework, toilet partitions, toilet accessories, handrails, visual display boards, identifying devices, finish hardware, flashing, wall and ceiling finishes, and other items as indicated. See also Specification Section - OWNER FURNISHED ITEMS for listing of N.I.C. items that will require blocking coordination.
    - a. Coordinate placement of blocking and supports with manufacturer or supplier of items.
  5. Fireblocking shall be provided to cut off all horizontal and vertical concealed draft openings in accordance with CBC Section 718.2.
    - a. Horizontal Fireblocking in walls shall be typically placed at 4'-0" above finished floor, at 8'-0" above finished floor, at mezzanine floor plane unless otherwise indicated, and at ceiling line plane.
  6. Bridging shall be installed in all joist members deeper than 8 inches unless otherwise indicated.
    - a. Bridging shall extend the full depth of the joists.
    - b. Drill bridging within attics to provide ventilation as indicated.
- I. Plywood Sheathing Panels:
  1. For panels with different veneer face grades, the exposed face shall always be the higher grade.
  2. Space panels 1/8 inch at all edge and end joints, and in accordance with APA.
  3. Panels shall be applied with the long dimension (or strength axis) across the framing.
  4. Fasten from the field of the panel first and then to the ends and edges to reduce stressing of the panel surfaces.
  5. Center all joints over bearing supports.
  6. Wall panels shall continue uninterrupted by ceilings or soffits from floor to floor or roof unless otherwise indicated.
- J. Sheathing:
  1. Shall be in accordance with the following:
    - a. Wall Sheathing: CBC Section 2304.6 and Table 2304.6.1.
    - b. Floor and Roof Sheathing: CBC Section 2304.8.
    - c. Structural Floor Sheathing: CBC Section 2304.8.1.
    - d. Structural Roof Sheathing: CBC Section 2304.8.2.
    - e. Lumber Decking: CBC Section 2304.9.
- K. Nailers and Grounds:
  1. Shall be installed as indicated and where required for attaching other work.

2. Form to shapes indicated.
  3. Coordinate locations with other work involved.
  4. Provide nailers at all flashing and edge terminations when required by roofing manufacturer for metal and concrete roof decks. When the roof system is required to be Class A use fire-retardant treated wood.
  5. Provide permanent Grounds of dressed, pressure-preservative-treated, Key-beveled wood and of thickness required to bring face of ground to exact finish thickness of finish material. Remove temporary grounds when no longer required.
- L. Furring and Stripping
1. Shall be installed as indicated and where required to provide fastening material or space for the passage of pipes, conduits, etc. not accommodated including ceiling stripping.
- M. Sealant:
1. When indicated, Primer shall be in accordance with sealant manufacturer recommendations.
  2. When indicated, Joint Sealer shall be in accordance with Specification Section - SEALANTS.

### 3.4 CONSTRUCTION

- A. Draftstopping:
1. Shall be provided in floor, attic, and ceiling areas in accordance with CBC Section 718.3 and 718.4.
- B. Pipes:
1. Frame to avoid cutting or drilling for passage of pipes, ducts, and conduit.
  2. Follow criteria as indicated for cutting or drilling. Unusual edge distances and awkward spacing and sizes shall be brought to the Architects attention for remedy.
- C. Chimneys and Flues:
1. Keep all framing 2 inches away from chimney or flues in accordance with CBC Section 2304.5.
- D. Cant Strips and Crickets:
1. Shape to sizes indicated.
  2. Rigidly fasten to construction.
  3. Block all joints of plywood panel construction.
  4. Form neat and mitered corners.
- E. Temporary Enclosures:
1. Provide and maintain all barricades and enclosures required to protect the work in progress.
- F. Shoring or Bracing:
1. Shore or brace for temporary support of all work as required during the construction period except any shoring and bracing specified and included under other sections of this Project Manual.
- G. Wood Curbs for Equipment:
1. Construct all wood curbs for roof mounted equipment.
  2. Provide all miscellaneous blocking, bracing, supports, and other wood items to complete the work.

### 3.5 FIELD QUALITY CONTROL

- A. Site Tests:
1. As required by Regulatory Requirements.
  2. Project Inspector shall verify by means of a handheld moisture content meter that all wood and plywood supplied at the time of incorporation into structure(s) has met applicable moisture content requirements.
  3. Project Inspector shall test all stud cavity walls to ensure that studs are a maximum of 19 percent moisture content prior to any other construction that encloses the wall cavity.

- B. Inspection:
  - 1. As required by Regulatory Requirements.
  - 2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
  - 3. No work shall be without the inspections required by Regulatory Requirements.

### 3.6 CLEANING

- A. Removal of Debris:
  - 1. Remove all Wood, including form lumber, chips, shavings and sawdust in or on the ground from the areas inside buildings. Do not bury debris in fill.

END OF SECTION

## SECTION 06 17 33 – WOOD JOISTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Wood Joist materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents, and as follows:
    - a. All Wood Joists, joist blocking, bridging, etc., for the installation of joists.
    - b. Clips, angles, straps, hangers, etc., incidental to installation of joists.
    - c. Nails, bolts, washers and other fasteners used for erecting and securing Wood Joists.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 07 21 00 INSULATION
  - 5. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 6. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ICC International Code Council
    - b. NDS National Design Specification for Wood Construction
    - c. NIST National Institute of Standards and Technology
    - d. PS Product Standard; of the US Department of Commerce

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Indicate wood joist material and dimensions and include construction and application details.
  - 2. Shop Drawings.
    - a. Submit shop drawings prepared by, or under the supervision of, a registered Civil or Structural Engineer in the State of California. Detail fabrication and installation of the work under this section, as well as procedures, diagrams, and attachment to other units of work. Each Drawing Sheet shall be stamped and signed by said engineer.
  - 3. Quality Assurance/Control Submittals:
    - a. Reports:
      - 1) Submit product ICC Evaluation Reports.
    - b. Certificates:



- 1) Provide document indicating Manufacturing facility has met the approval of an independent ICC Approved Inspection Agency.
- 2) Provide document indicating 3 projects of similar size that the proposed installer has successfully completed.
- c. Manufacturer's Field Installation Review Reports:
- d. Engineering Calculations:
  - 1) Submit Engineering Calculations computed, stamped, and signed by a registered Civil or Structural Engineer in the State of California.
4. Closeout Submittals:
  - a. Warranty in accordance with specification section –WARRANTIES.
  - b. Project "AS-BUILT" Documents and Project "RECORD" Documents.

#### 1.4 QUALITY ASSURANCE

##### A. Qualifications:

1. Material Qualifications:
  - a. All materials shall be in accordance with ASTM Requirements, ICC Evaluation Reports, and DSA IR A-5 and manufacturers engineering requirements.
2. Installer Qualifications:
  - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
3. Manufacturer/Supplier Qualifications:
  - a. Firm experienced in successfully producing and supplying products indicated for this Project, with sufficient capacity to supply required units without causing delay in the work.
  - b. Manufacturing facility shall be approved by an independent ICC approved inspection agency.
  - c. Capable of providing competent on-site review of product installation and written verification of compliance with installation requirements.
  - d. Obtain each type of product through one source from a single manufacturer.

##### B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. DSA IR Division of the State Architect, Interpretation of Regulations.
    - 1) Including DSA IR 23-9 "Prefabricated Wood I-Joist: 2022 CBC."

##### C. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

- b. Maintaining installed work until the Notice of Substantial Completion has been executed.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
  - 1. Products shall be handled in such a manner as to assure that they are free from gouges, scratches and other damage.
- B. Acceptance at Site:
  - 1. Products must be in the approved manufacturer's original packaging with labels indicating brand name, size, and grade.
  - 2. Damaged products will not be accepted.
- C. Storage and Protection:
  - 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.6 PROJECT CONDITIONS

- A. Existing Conditions:
  - 1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  - 2. Field Measurements: Take and be responsible for field measurements as required. Report any significant differences between field dimensions and the contract document conditions to Architect.
  - 3. Carefully coordinate work under this Section with that of the structural framing sections and details so that the interface between structural framing and non structural framing shall provide the lines and degree of finish shown and specified.

## 1.7 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES
    - a. Warranty Period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified product manufacturer:
    - a. REDBUILT "Red-165" per drawings.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.
  - 1. Other manufacturer's products complying with these specifications and having equivalent properties and dimensions shall be subject to Architect's and DSA's review upon submission of substantiating data. Structural capacities shall be evaluated by ASTM D 5055 "Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists," and independent structural testing.

## 2.2 MATERIALS

- A. Flanges:
  - 1. Structural Composite Lumber Flanges shall be in compliance with the requirements of ASTM D 5456 "Specification for Evaluation of Structural Composite Lumber Products."
- B. Webs:
  - 1. Structural panel webs shall be of Oriented Strand Board in compliance with PS2, Exposure 1, or Plywood in compliance with PS1, Exterior Grade.
    - a. Oriented Strand Board material of I-Joists shall be stamped with the Brand Name, grade, thickness, mill location, and mill number.
- C. Adhesives:
  - 1. Adhesives shall be exterior type and in compliance with ASTM D 2559 "Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions."

## 2.3 MANUFACTURED UNITS

- A. I-Joists:
  - 1. Prefabricated in accordance with DSA IR 23-9, ICC Evaluation Service Report ESR-2994, and ASTM D 5055 "Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists."
  - 2. Miscellaneous blocking, bridging, rim joists and web stiffeners, shall be furnished per above listed regulations, references, and standards.

## 2.4 ACCESSORIES

- A. Fasteners: Refer to Specification Section – ROUGH CARPENTRY.
- B. Metal Framing Anchors: Refer to Specification Section – ROUGH CARPENTRY.

## 2.5 SOURCE QUALITY CONTROL

### A. Fabrication Tolerances:

1. Fabrication shall be in compliance with specified standard and industry specifications and requirements of DSA IR 23-9 and ICC Evaluation Service Report #ESR-2994.
  - a. Fabrication shall be in accordance with best practices with adequate plant and equipment and under supervision of properly qualified personnel and at a plant stated in the Listing Report.
  - b. Moisture content of components at time of gluing shall not be less than 7 percent nor more than 16 percent.
  - c. Depth: Plus or Minus 1/16".
  - d. Flange Width: Plus or Minus 1/16".

### B. Identification:

1. All joists shall bear a stamp indicating the joist series, ICC-ES Evaluation Report Number, manufacturer's name, plant number, date of fabrication, and independent inspection agency's logo.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Site Verification of Conditions:

1. Prior to the execution of the work, inspect the installed work executed under other specification sections which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

#### A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

#### B. Protection:

1. Protect all adjacent surfaces from damage from work under this specification section.

### 3.3 ERECTION

#### A. General:

1. Joists are to be erected and installed in accordance with the drawings and manufacturers recommendations. Comply with all manufacturer's written recommendations concerning temporary construction loads and erection bracing.
  - a. Temporary construction loads that cause stresses beyond design limits are not permitted. Safety bracing shall be provide by the installer to keep the joists straight and plumb as required and to ensure adequate lateral support for the individual joists and the entire system until sheathing material has been applied.
  - b. The Contractor shall give notification to the joist manufacturer's representative, prior to enclosing the joists, to provide an opportunity for review of the installation.

2. In accordance with approved shop drawings.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Use equipment and methods that avoid damages that may impair strength of Wood I-Joists joists. Sharp instruments and unprotected wire rope, chain slings and the like shall not be permitted.
6. Damaged products shall not be installed.

B. Layout:

1. Lines shall be straight and true.

### 3.4 FIELD QUALITY CONTROL

A. Inspection:

1. As required by Regulatory Requirements.
2. Manufacturer's representative shall provide on-site Field Installation Review Report indicating compliance with manufacturer's requirements.

### 3.5 CLEANING

A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.

1. Keep premises free from accumulated waste materials, rubbish and debris resulting from this Work. Upon completion, remove tools, appliances, surplus materials, waste materials, rubbish, debris and accessory items used in or resulting from said Work, and legally dispose of off the site.

END OF SECTION

**SECTION 06 18 00 – GLUE-LAMINATED CONSTRUCTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provide all material, labor, equipment and services necessary to furnish and install all Glue-Laminated Structural Units, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS (Hangers, Angles, Plates and Bolts)
  - 4. 06 10 00 ROUGH CARPENTRY
  - 5. 09 91 00 PAINTING
  - 6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 7. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.2 REFERENCES**

- A. Standards:
  - 1. AITC American Institute of Timber Construction "Standard Specification for Structural Glued Laminated Timber of Softwood Species," (AITC 117-latest edition).
  - 2. ALSC American Lumber Standards Committee.
  - 3. ANSI American National Standards Institute ANSI A 190.1, "Structural Glued Laminated Timber."
  - 4. APA The Engineered Wood Association (Formerly the American Plywood Association).
  - 5. AWWPA American Wood-Preserver's Association.
  - 6. WCLA West Coast Lumbermen's Association.
  - 7. WCLIB West Coast Lumber Inspection Bureau.

**1.3 SUBMITTALS**

- A. Submit Shop Drawings in accordance with Specification Section – SUBMITTAL PROCEDURES.
- B. Quality Assurance/Control Submittals:
  - 1. Test Reports:
    - a. Submit verified report by an approved Glue Fabrication Inspector that all units have been fabricated in accordance with CBC Section 2303.1.3.
    - b. Submit Independent Testing Lab Reports for all materials delivered to the project.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
    - b. DSA Division of the State Architect

- c. UL Underwriter's Laboratories
  - d. USCS U.S. Commercial Standards
- B. Inspection:
  - 1. All structural glued-laminated timber shall be continuously inspected during fabrication by a glue fabrication inspector specially approved for that purpose by the enforcement agency DSA/SSS.
    - a. Costs of inspection will be paid by Owner.
    - b. An AITC Certificate will not meet this requirement.
- C. Identification:
  - 1. Each structural glued-laminated timber shall be stamped with an identifying mark.
    - a. The glue fabrication inspector shall make a verified report identifying the timbers by mark and including pertinent data such as the grade and species of lumber, the type of glue, the extremes of moisture content, and such other information as may be required.
    - b. The glue fabrication inspector's verified report shall show, of his/her own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in accordance with and in conformity to the duly approved plans and specifications.
    - c. The verified report shall either certify the use of official grading bureau marks as required, or that lumber grades were determined by a grader authorized to grade lumber under the provisions of the American Lumber Standards Committee and who is also trained to grade the tension laminations required and described in ANSI/AITC A190.1 and ASTM D 3737 "Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)."
  - 2. All members shall be fabricated with exterior type glues for "wet use."

## 1.5 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty: 1 Year.
  - 1. In accordance with manufacturer's written standard warranty.
- C. Installer's Warranty: 1 Year.
  - 1. In accordance with the terms of the Specification Section - WARRANTIES

## PART 2 - PRODUCTS

### 2.1 GLUE-LAMINATED STRUCTURAL UNITS

- A. Beams:
  - 1. Wood Laminations:
    - a. Standard: ANSI A 190.1 "Structural Glued Laminated Timber."
    - b. Species:
      - 1) Douglas Fir for interior conditions.
      - 2) Alaskan Cedar for exterior conditions.
    - c. Thickness: 1-1/2 inches net maximum or as noted on Drawings.
    - d. Width: Full width of member.
    - e. Moisture Content (at time of gluing): 7 to 12 percent. Range of moisture content of laminations in a single unit shall not exceed 5 percent.
  - 2. Glue-Laminated Units:
    - a. Stress Values:
      - 1) Douglas Fir:
        - a) Simple Span: Combination Symbol 24 F-V4.

- b) Cantilever and Continuous: Combination Symbol 24 F-V8.
  - 2) Alaskan Cedar:
    - a) Simple Span: Combination Symbol 20F-VXX.
    - b) Cantilever and Continuous: Combination Symbol 20F-VXX.
- b. Appearance:
  - 1) Industrial Appearance Grade in accordance with AITC Standard 110 where not exposed in a finished space. Bottom lamination of exposed beams and arches, knots may occupy not more than 10% of cross section.
  - 2) Architectural Appearance Grade in accordance with AITC Standard 110 where exposed to view in a finished space. Bottom lamination of exposed beams and arches, knots may occupy not more than 10% of cross section.
- c. Camber:
  - 1) As indicated on drawings.
- d. Adhesives:
  - 1) In accordance with ANSI A 190.1, "Wet-Use" Type.
- e. Sealer:
  - 1) End: In accordance with manufacturer's standard, transparent, colorless wood sealer, effective in retarding transmission of moisture at cross-grain cuts, compatible with the laminating adhesives, CARB Standards, and any finish coats specified.
  - 2) Penetrating: In accordance with manufacturer's standard, translucent, penetrating wood sealer, that will not interfere with application of wood stain and transparent finish, or paint finish, compatible with the laminating adhesives and CARB Standards.
    - a) Refer to Specification Section – PAINTING for required field-applied finishes.

## 2.2 FABRICATION

- A. Fabrication in accordance with ANSI A190.1.
  - 1. All cutting and trimming of beams shall be done in the field with one end wild.
- B. End Joint Type: In accordance with ANSI A190.1.
- C. End Joint Spacing:
  - 1. Well scattered throughout unit.
  - 2. Distance between end portions of joints in adjacent laminations.
    - a. 6 inches minimum in tension portion (1/8 beam depth plus one lamination – bottom at V4, and top and bottom at V8).
- D. Wood within 6 inches of joint fastening: Free of knots and local grain truss deviation.
- E. Joint details and fabricating plan and procedures: Approved by Architect.
- F. Proof Loaded Finger Joint Test Values: In accordance with ANSI A190.1.
- G. Moisture Content at Time of Gluing: 12 percent maximum and 7 percent minimum.
- H. Camber as noted on the drawings.
- I. Seal ends with 2 coats of sealer.

## 2.3 SOURCE QUALITY CONTROL

- A. Tests, Inspection:
  - 1. Plant shall provide a report from the Glue Fabrication Inspector that all units have been fabricated in accordance with CBC Section 2303.1.3.



**PART 3 - EXECUTION**

**3.1 INSTALLATION**

**A. General:**

1. Install miscellaneous steel connectors, anchors, and accessories.
2. Plan and execute erection procedures so that close fit and neat appearance of joints and structure as a whole will not be impaired. When hoisting members into place, use padded or non-marring slings, and protect corners with wood blocking.
3. Adequately brace members as they are placed to maintain safe position until full stability is provided.
4. Avoid cutting glulam members during erection. Except for fastener drilling and other minor cuttings, coat cuts with end sealer.
  - a. Where treated members must be cut during erection, apply a heavy brush coat of the same preservative treatment, complying with AWPAC Standard M4.
5. Handle and temporarily support members to prevent visible surface damage.
6. Do not remove wrapping on individually wrapped members until it will serve no useful purpose, including protection from weather, soiling and damage from work of other trades.
  - a. Coordinate wrapping removal with finished in work specified in Division 9. Retain wrapping wherever it can serve as a painting shield.
7. Repair damaged surfaces and finishes after completing erection and removing wrappings, or replace damaged members as directed where damage is beyond acceptable repair.

**3.2 PROTECTION**

- A. Control heating, ventilating, and air conditioning in building to avoid damage to or deterioration of glulam work.
- B. Protect glued laminated timbers during transit, storage and erection in accordance with AITC Standard III to prevent any damage.
  1. Individually wrap each member to be left exposed, and cut bottom of wrapping only (do not mar beam) to alleviate condensation buildup while storing.
  2. Each member shall be fabricated with wet use adhesive.
  3. Bundle wrap all other members.

**END OF SECTION**

## SECTION 06 22 00 – MILLWORK

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Furnish all material, labor, equipment and services necessary to furnish Millwork, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 30 00 CAST-IN-PLACE CONCRETE
  - 5. 06 41 23 MODULAR CASEWORK
  - 6. 08 70 00 HARDWARE
  - 7. 08 80 00 GLASS
  - 8. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 9. 09 91 00 PAINTING
  - 10. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. AWS "Architectural Woodwork Standards," Latest Edition, including latest amendments, by the Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
    - b. DOC U.S. Department of Commerce
    - c. ICC International Code Council
    - d. NIST National Institute of Standards and Technology
    - e. NWMA "Industrial Standard" National Woodwork Manufacturer's Association.
    - f. PS Product Standard (as issued by the DOC)
    - g. WI Woodwork Institute.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Shop Drawings.
    - a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
  - 2. Samples.
    - a. Provide 6 inch square sample of each color and pattern selected.

## 1.4 QUALITY ASSURANCE

- A. In accordance with Specification Section - REGULATORY REQUIREMENTS.

## 1.5 DELIVERY, STORAGE, AND HANDLING

## A. Storage and Protection:

1. Millwork shall not be delivered to the Project until the Work is sufficiently complete to properly accept, store and protect Millwork.

## 1.6 PROJECT CONDITIONS

## A. Environmental Requirements:

1. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
2. Burning: No burning will be allowed on-site.
3. Temperature: Maintain ambient temperature in space to receive products between fifty (50) degrees Fahrenheit and ninety (90) degrees Fahrenheit for seven (7) days prior, during, and seven (7) days minimum following installation. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn over of the building or facility to the Owner.
4. Humidity: Maintain relative humidity in space to receive products between 45 percent and 65 percent at 60 degrees to 90 degrees F, and EMC (Equilibrium Moisture Content) conditions between 8 percent and 12 percent for 72 hours minimum prior, during, and following installation in accordance with manufacturer's written recommendations.

## B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

## 1.7 WARRANTY

## A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

## B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
  - a. Warranty Period One (1) Year.

## C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES
  - a. Warranty Period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

## A. Wood:

1. Use new, kiln-dried, clean stock lumber of the species and grades as scheduled or specified. Moisture content from time of Manufacture until time of installation shall be a minimum of 5 percent and shall not exceed 10 percent up to 2" nominal thickness and shall not exceed 19 percent for pieces thicker than 2" up to 9" nominal thickness.
2. Decking:
  - a. Provide sizes and patterns shown on the drawings; complying with the following grade requirements of referenced woodworking standard, for quality of materials and manufacture:

- b. Quality of work Custom.
- c. Species:
  - 1) Clear, kiln-dried hardwoods as described below:
    - a) Species and Cut: Plain-sawn, clear, kiln-dried teak selected for compatible grain and color.
  - 2) Texture: Surfaced (Smooth).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

##### A. Site Verification of Conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.
4. Job Measurement:
  - a. Take field measurements as required and be responsible for verification of space available. Report any discrepancy between Drawings and field dimensions to the Architect.

#### 3.2 PREPARATION

##### A. Coordination:

1. Cooperate with Work performed under other sections as required to produce a satisfactory installation conforming to the full intent of the Drawings, Specifications, and the referenced standards.

#### 3.3 INSTALLATION

- ##### A.
- Installation shall be in accordance with WI Custom standards.

END OF SECTION

## SECTION 064123 – MODULAR CASEWORK

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Modular Casework materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    - a. Plastic laminate-faced casework.
    - b. Adjustable shelf supports: Bored-Hole Shelf Rest Systems
    - c. Solid-Surface countertops.
    - d. Plastic Fabrications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 15 14 DRILLED ANCHORS
  - 4. 03 30 00 CAST-IN-PLACE CONCRETE
  - 5. 05 12 00 STEEL AND FABRICATIONS
  - 6. 08 70 00 HARDWARE
  - 7. 09 29 00 GYPSUM BOARD
  - 8. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 9. 09 68 40 CARPET
  - 10. 09 72 00 WALL COVERINGS
  - 11. 09 91 00 PAINTING
  - 12. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 13. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. BHMA BHMA stands for Builders Hardware Manufacturers Associates, Inc.
    - b. NAAWS "North American Architectural Woodwork Standards," Latest Edition, including latest amendments, by the Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
    - c. NEMA National Electrical Manufacturers' Associates, Publication Number LD3, latest-edition
    - d. NIST National Institute of Standards and Technology
    - e. NWMA "Industrial Standard" National Woodwork Manufacturer's Association.
    - f. PS Product Standard of the U. S. Department of Commerce
    - g. WI Woodwork Institute

## 1.3 DEFINITIONS

- A. Refer to NAAWS.

- B. Exposed Portions:
1. Face members and edges of cabinets (cabinet fronts), such as face plates, drawer fronts, door fronts, front edge of shelves.
  2. Interior faces of cabinet doors.
  3. Underside of bottoms of upper cabinets, 48" above finished floor.
  4. Cabinet tops:
    - a. Under 72" above finish floor.
    - b. Visible from upper building level.
  5. Interior surfaces (including top, bottom, and front of shelves) of open cabinets or cabinets with glass doors.
  6. All surfaces of exposed shelves.
  7. All surfaces exposed to view.
- C. Semi-Exposed Portions:
1. Cabinet divisions, shelves, insides of drawers, and any other cabinet members which cannot be seen when door or drawers are closed.
- D. Concealed Portions:
1. Cabinet framing that cannot be seen, such as web frame members, sleepers, dust panels, toe strips covered with resilient base.
- E. Shelving:
1. Top and bottom surfaces. Face surfaces are the front and rear edges.
    - a. Ends are the left/right edges as you face the cabinet.
  2. The bottom surface material of all Upper Cabinets attached to walls shall be considered a shelf and manufactured as a shelf.
- F. Quality Assurance Options:
1. Certified Compliance Program (CCP):
    - a. The CCP is an established discipline of quality control, for use in conjunction with the NAAWS, which provides a non-biased means of confirming conformance to a project's drawings and specifications.
    - b. Contractor to provide field inspection by WI Director, additional to CCP requirements.
    - c. The Woodwork Manufacturer shall have no less than 5 years of production experience, similar to this project, whose qualifications indicate the ability to comply with the requirements of this Section.
    - d. The Woodwork Manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.
  2. Monitored Compliance Program (MCP):
    - a. The MCP is an established discipline of quality control, for use in conjunction with the NAAWS, which provides a non-biased means of confirming conformance to a project's drawings and specifications,
    - b. Includes ongoing review/inspections of the project from its start to certification at completion.
    - c. The Woodwork Manufacturer shall have no less than 5 years of production experience, similar to this project, whose qualifications indicate the ability to comply with the requirements of this Section.
    - d. The Woodwork Manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.

#### 1.4 SYSTEM DESCRIPTION

- A. Performance Requirements: It is the intention of this specification section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
1. All shelving must be manufactured according to NAAWS for Schools, Hospitals and Library or Book Shelving. 50 lbs./SF.

#### 1.5 SUBMITTALS

A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
  - a. Submit manufacturer's full color range (including any standard and premium colors) for selection by the Architect.
  - b. Submit 2 copies of Manufacturer's current specifications for Modular Casework including all types of cabinets and accessories included in this section to the Architect for approval prior to fabrication.
2. Shop Drawings.
  - a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, seam locations, components, and location and size of each field connection.
  - b. Shop Drawing format in accordance with NAAWS Section 1, Submittals and WI's Certified Compliance Program.
    - 1) The shop drawings for the modular casework shall comply with and bear the WI CERTIFIED COMPLIANCE LABEL.
    - 2) Each elevation of casework, each laminated plastic top, and each solid surface top shall bear a WI CERTIFIED COMPLIANCE LABEL.
    - 3) Indicate spacing of all hardware accessories for Architect's review of layout.
    - 4) On casework and countertop elevations show the location of backing required for attachment within walls.
    - 5) Before delivery to the jobsite the woodwork supplier shall provide a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the millwork products being supplied and Certifying that these products fully meet the requirements of the Grade or Grades specified.
    - 6) At completion of installation the woodwork installer shall provide a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the products installed, and Certifying that the installation of these products fully meets the requirements of the Grade or Grades specified.
    - 7) All fees charged by the Woodwork Institute for their Certified Compliance Program are the responsibility of the millwork manufacturer and/or installer and shall be included in their bid.
3. Samples.
  - a. Provide nominal 2" x 3" sample chains of manufacturer's non-premium and premium laminate color selection lines.
    - 1) Submit color samples of Manufacturer's full color and pattern range (including wood grains) of non-premium and premium priced High Pressure Decorative Laminate to the Architect for color selection prior to fabrication.
      - a) See drawings for high pressure decorative laminate color selection.
    - 2) Submit color samples of high density overlay thermal-fused melamine for color selection by the Architect.
      - a) Samples shall be equivalent to SELPLY products, from their full color range selection chain of colors.

- 3) Provide finish color selection samples of Pilaster Standard. Specified colors subject to change.
- b. Mock-up as described elsewhere in this section.
4. Quality Assurance/Control Submittals:
  - a. Certificates:
    - 1) Submit three (3) copies of the following:
      - a) Before delivery to the jobsite, the modular cabinetwork supplier shall issue a WI CERTIFIED COMPLIANCE CERTIFICATE indicating the modular cabinetwork products and/or fabrication of products to be furnished for this project shall meet fully all the requirements of the grade or grades specified.
      - b) Upon completion of inspection of installation by WI Inspector, a WI CERTIFIED COMPLIANCE CERTIFICATE shall be furnished for the installation.
    - 2) Submit three (3) copies of a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.
  - b. Labels:
    - 1) Each plastic laminate countertop supplied shall bear the WI CERTIFIED COMPLIANCE LABEL.

## 1.6 QUALITY ASSURANCE

### A. Qualifications:

1. Material Qualifications:
  - a. Grades as indicated on the drawings in accordance with the specifications, rules and details or casework of the NAAWS Sections 5 "Finishing," 10 "Casework," and 11 "Countertops," unless the drawings and these specifications modify said standards.
    - 1) See Appendix "A" for "Cabinet Design Series" (CDS) Number System used on Modular Casework Schedule.
  - b. Laminated Plastic Countertops, Splashes, and Wall Paneling in accordance with NAAWS Section 11 "Countertops."
2. Installer Qualifications:
  - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
3. Manufacturer/Supplier Qualifications:
  - a. Firm(s) experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
  - b. All modular Cabinet Work must be done by a Single Source WI licensed manufacturer and be able to provide a WI Certified Compliance Certificate.
  - c. Participation in Woodwork Institute Quality Assurance Program:
    - 1) If supplier is WI Member Licensee in good standing:
      - a) Comply with WI CERTIFIED COMPLIANCE PROGRAM (CCP).
      - b) Provide WI Director to inspect installation on-site.
    - 2) If supplier is not WI Member Licensee in good standing:
      - a) Comply with WI MONITORED COMPLIANCE PROGRAM (MCP).

### B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:



- a. CBC All hardware for casework shall meet CBC Section 11B-309.4 and 11B-811.4.
  - b. California ARB ATCM California Air Resource Board's Air Toxics Control Measure for Composite Wood, 17 CCR 93120
- C. Mockups:
- 1. Prior to fabricating or installing Modular Cabinet Work, construct a mockup to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Provide one lower cabinet with drawer, and one upper cabinet, with all examples of hardware for both lower and upper cabinets.
  - 2. Provide mock-up of exposed and interior cabinet surfaces with Pilaster Shelf Standard for review and comment prior to fabrication. Color selection of Pilaster may be subject to change.
- D. Meetings:
- 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with all other related work
    - b. identify potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
    - c. Review the locations of backing required for casework installation as shown on the casework shop drawings and the Contract Documents.
    - d. Review the method of attachment of the backing to the wall system as shown on the Contract Documents.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. WI Inspector, Project Inspector, and the Architect shall inspect and identify any problems that may impede issuance of warranties or guaranties.
    - b. Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading:
- 1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
- B. Acceptance at Site:
- 1. Hardware products (not already applied) must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Casework products must be free from scratches, gouges, or any other marring or discoloration.
  - 3. Damaged products will not be accepted.
- C. Storage and Protection:
- 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units, in compliance with PROJECT CONDITIONS below.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.8 PROJECT CONDITIONS

- A. Environmental Requirements:
1. Humidity and Temperature: Maintain humidity and temperature in the space to receive products between 45 percent to 65 percent at a temperature of 60 degrees to 90 degrees F. Equilibrium Moisture Content of the wood product conditions shall be maintained between 8 percent and 12 percent. Maintain these requirements for four (4) days minimum prior, during, and following installation in accordance with manufacturer's written recommendations. Inform the Owner of humidity requirements for products installed and maintain until Substantial Completion and the turn-over of the building or facility to the Owner.

## 1.9 WARRANTY

- A. Contractor's General Warranty:
1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES
    - a. Warranty Period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified product manufacturers:
    - a. High Pressure Decorative Laminate: WILSONART.
      - 1) Cabinet Liner Series Type CLS.
    - b. Low Pressure Thermal-fused:
      - 1) AMERICAN LAMINATE, PANELAM, or ROSEBURG FOREST PRODUCTS.
    - c.
    - d. Plastic Fabrications: 3-FORM.
    - e. Cabinetry Hardware: See Cabinet Hardware Schedule.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 CABINET MATERIALS

### A. Exposed Materials:

1. General:
  - a. In accordance with NAAWS Section 4 - Sheet Products.
  - b. Minimize seams.
2. Laminate Systems:
  - a. Decorative Laminate:
    - 1) Horizontal Surfaces: Post-formed Grade HGP (0.042").
    - 2) Vertical Surfaces: Grade VGP (0.027").
      - a) Pattern direction: Vertical, unless otherwise noted.
  - b. Edgebanding:
    - 1) Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors and drawer fronts, 0.5 mm thick elsewhere. Color to match adjacent material.
  - c. Hardware:
    - 1) Attachment Method: Top Support, Top Hung with End Cap
      - a) Panel to have factory pre-drilled Slots at the top of the panel for attachment.
      - b) Finish: Powder Coat, Custom Color to match Panel.

### B. Semi-Exposed Materials:

1. Cabinet Liner:
  - a. Complying with requirements of NEMA LD-3, Grade CLS.
2. Edgebanding:
  - a. Rigid PVC extrusions, through color with satin finish.
    - 1) Typical: 0.5 mm thick.
    - 2) Front edge of shelves and all edges of drawers: 3 mm.

### C. Concealed Materials:

1. Medium Density Fiberboard (MDF): ANSI A208.2.
  - a. Grade 130.
  - b. Grade 155.
2. Particleboard: ANSI A208.1, Grade M-2.
  - a. 44-50 lb Industrial Grade core.
  - b. Thickness Swell max: 5.5 percent.
3. Veneer Core Hardwood Plywood (VCHP):
  - a. No internal voids.
  - b. MDF cross bands to limit telegraphing of core grain is acceptable.

### D. Fasteners:

1. Per NAAWS.
2. Corrosion resistant fasteners throughout the assembly of modular casework.
3. Confirmat screws.

## 2.3 FABRICATION

### A. General:

1. In accordance with NAAWS Section 10 - Casework, Custom Grade, as amended by the Contract Documents.
2. Interface Style, Frameless: Flush Overlay.

3. Seismic Force Requirements - The types of construction approved by WI that meet CBC Title 24 seismic force requirements are: Lock Joint, Dowled, Dowled / Screwed Construction, Rabbeted Construction, Conformat Screws, Fully Plowed-in Back, and Backs Screwed on in rabbeted ends, tops, and bottoms. The exact method for seismic force construction is available from WI.
4. Construct openings and backing as required for work done under Division 22 PLUMBING (sinks, plumbing, etc.) and Division 26 ELECTRICAL (outlets, switches, wiring, etc).
  - a. Exposed Edges: All exposed edges shall be sealed; including sink cut-outs & bottom edges of front edges.
5. Cabinets ganged together or attached to the wall shall be attached with countersunk screws to prevent binding of shelves when provided later.
6. Any vertical or horizontal plane surface less than four (4) foot wide and twelve (12) foot long shall be faced with one continuous sheet with the intent to minimize the number of seams throughout the work, in compliance with NAAWS Section 8 "Wall Surfacing."
7. Exposed ends, panels, and back panels shall flush out with face of doors and drawer fronts.

B. Cabinets:

1. Cabinet box:
  - a. Bottoms and Ends of Cabinets: 3/4-inch particleboard.
  - b. Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard.
  - c. Backs of Cabinets: Particleboard.
    - 1) Concealed Backs: 1/4" minimum.
    - 2) Exposed Backs: 1/2" minimum.
2. Filler Strips:
  - a. Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
3. Shelving System:
  - a. Shelf Support System:
    - 1) Bored Hole Shelf Rest Systems:
      - a) Glass Shelves at Custom Trophy Case: Locking Peki Glass Shelf Pin by Richelieu, Or approved equal. Minimum Load Capacity of 70 kg per Shelf.
      - b) 5mm diameter holes drilled approximately 8 mm deep, 32 mm o.c.
      - c) The front and rear row of holes shall be 37 mm from the front and rear edge of the cabinet.
      - d) Provide full cabinet height holes at 32 mm o.c. in each row to allow maximum flexibility of the user to arrange shelves.
    - 2) Provide four clips for each shelf.
  - b. Shelves:
    - 1) Veneer Core Hardwood Plywood.
      - a) Span less than 25-inches: 3/4-inch.
      - b) Span greater than 25-inches: 1-inch.
      - c) Library shelves of any span: 1-inch thick.
    - 2) Tempered Safety Glass.
      - a) 3/8-inch
4. Doors:
  - a. Doors: 11/16 inch core, 3/4 inch thick finished.
    - 1) Core material: MDF grade 130.
  - b. Large doors: 1 inch core, 1-1/16 inches thick finished.
    - 1) Large doors are more than 48 inches high and more than 24 inches wide.
    - 2) Core material: MDF grade 155.

- c. Stiles and Rails of Glazed Doors: 3/4 inch thick.
  - 1) Core material: Particleboard.
- d. Hinges:
  - 1) Let in 1/8 inch reveals for institutional hinges.
  - 2) Up to 48" high Doors: 3 hinges unless otherwise indicated on the drawings.
  - 3) 48" to 80" high Doors: 4 hinges unless otherwise indicated on the drawings.
  - 4) Door higher than 80": 5 hinges unless otherwise indicated on the drawings.
- 5. Drawers:
  - a. Drawer Fronts: 3/4-inch Particleboard.
  - b. Drawer Sides and Backs: 1/2-inch Veneer-Core Hardwood Plywood.
    - 1) Joined using Conformat Screws in lieu of dowels.
  - c. Drawer Bottoms: 1/2-inch Veneer-Core Hardwood Plywood glued and dadoed into front, back, and sides of drawers.
  - d. File Drawers / Lateral File Drawers:
    - 1) Sides: 3/4-inch Veneer-Core Hardwood Plywood.
    - 2) Bottoms: 5/8 inch Veneer-Core Hardwood Plywood.
    - 3) Sides and bottoms shall be secured using 2-inch Conformat screws.
    - 4) Accessories: COMPX "Timberline" frames.
  - e. Security Panels: 1/2-inch Veneer-Core Hardwood Plywood.
    - 1) Provide Security Panels above and below all locking drawers.
- 6. All drawers and doors shall be locked, keyed alike in each room and with building masters and grand master.
  - a. Each room shall be keyed alike:
    - 1) Provide 4 keys per lock.
    - 2) Provide 6 master keys.

C. Countertops:

- 1. General: In accordance with NAAWS Section 11 -- Countertops, as amended by the Contract Documents.
  - a. .

D. Hardware:

- 1. See schedule at the end of this section for typical cabinet hardware.
- 2. Hardware shall be furnished and installed as required to provide a complete casework installation for overlay construction, unless noted otherwise.
- 3. Provide metal strike at locks.
- 4. Finish: BHMA 626 (26D), unless otherwise noted.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Site verification of conditions:

- 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual, which affect the execution of work under this specification section.
- 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
- 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work specified under this specification section.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

### 3.3 INSTALLATION

- A. General:
  - 1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    - a. Provide experienced, factory trained craftspeople under manufacturers direct supervision.
  - 2. In accordance with approved submittals.
  - 3. In accordance with Regulatory Requirements.
  - 4. The entire installation shall present a first class, workmanlike appearance, without open joints, tool marks or other blemishes, and subject to the Architect's approval.
  - 5. Edges of cutouts, subject to excessive moisture, shall be sealed with a color-toned (for verification), water-resistant sealer before trim or sink rims are installed.
- B. Layout:
  - 1. Set plumb, level, and to true lines as shown on the drawings.
  - 2. Filler panels and scribe strips or moldings, as required, shall be properly scribed to adjacent work and securely attached to cabinets as indicated on the drawings.
- C. Anchorage:
  - 1. The backs of the cabinets shall be secured to the wall backing.
  - 2. Refer to the Drawings for the backing and anchorage details.
- D. Cabinet Bases:
  - 1. Toe Kick: Cabinet base shall be set back from the face of the cabinet 3-inches, or as indicated
  - 2. Cabinet sides: Cabinet shall be set 3/8-inch back from the face of the cabinet.

### 3.4 FIELD QUALITY CONTROL

- A. Inspection:
  - 1. Schedule WI inspection with a minimum of 7 days notice of planned installation.
  - 2. Schedule inspections and notify the Architect, Owner's Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
  - 3. No work shall be without the inspections required by Regulatory Requirements.

## 3.5 ADJUSTING

- A. Test and adjust carpentry hardware. Replace damaged or malfunctioning controls and equipment.

## 3.6 CLEANING

- A. Clean in accordance with Specification - PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces immediately.
  - 2. In accordance with manufacturer's written instructions and recommendations.
  - 3. Finish shall be clean and ready for the application of any additional finishes.

## 3.7 PROTECTION

- A. Protection from traffic:
  - 1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

## 3.8 SCHEDULES

- A. Standard Cabinetry Hardware specified, or approved equivalent:
  - 1. Hinges: Institutional Hinges for Overlay doors, 2-3/4" five knuckle with hospital tips and 2-5/8" extended side panel wing:
    - a. ROCKFORD PROCESS:
      - 1) #374 for 3/4" side panel x 3/4" thicknesses.
      - 2) #376 for 3/4" side panel x 13/16" thicknesses.
  - 2. Pulls (Steel Wire "U" Shaped - 4" centers, 1-1/4" Projection from face of drawer or door):
    - a) JAMISON: SWP4-26D.
  - 3. Locks (Hinged Doors and Drawers for Overlay Construction):
    - a. COMP X NATIONAL: #C8053.
    - b. Approved equivalent manufacturer:
      - 1) OLYMPUS LOCK, INC. #DCN as required.
    - c. Provide compatible strike.
    - d. OLYMPUS LOCK, INC. #DCN as required.
    - e. Approved equivalent manufacturer:
      - 1) COMP X NATIONAL: #C8053.
    - f. Provide compatible strike.
  - 4. Locks (Sliding Doors):
    - a. COMP X NATIONAL: #C8142 (3/4").
    - b. Approved equivalent manufacturer:
      - 1) KNAPE AND VOGT.: #KV984.
    - c. Provide compatible strike.
  - 5. Drawer Slides up to 24 inches Wide:
    - a. Pencil Drawers:
      - 1) 65 lb capacity, full extension, lever disconnect:
        - a) ACCURIDE 2632.
      - 2) Approved equivalent manufacturer:
        - a) KNAPE AND VOGT: 4400.
    - b. General Purpose Drawers:
      - 1) 100 lb capacity, full extension, rail mount disconnect:

- a) ACCURIDE 7432.
  - 2) Approved equivalent manufacturer:
    - a) KNAPE AND VOGT: 8400.
- 6. Drawer Slides over 24 inches Wide:
  - a. Pencil Drawers:
    - 1) 100 lb capacity, full extension, push latch disconnect:
      - a) ACCURIDE 3732.
    - 2) Approved equivalent manufacturer:
      - a) KNAPE AND VOGT: 8400.
  - b. General Purpose Drawers:
    - 1) 150 lb capacity, full extension, rail mount disconnect:
      - a) ACCURIDE 3641.
    - 2) Approved equivalent manufacturer:
      - a) KNAPE AND VOGT: 8500.
  - c. File Drawers:
    - 1) 200 lb capacity, full extension, rail mount disconnect:
      - a) ACCURIDE 3642.
    - 2) Approved equivalent manufacturer:
      - a) KNAPE AND VOGT: 8800.
  - d.
- 7. Adjustable Shelf Supports (zinc die-cast nickel plated supports) for glass shelves:
  - a. HETTICH: #1 010 564.
- 8. Adjustable Shelf Supports (zinc die-cast nickel plated supports):
  - a. HETTICH: #1 005 767.
  - b. Approved equivalent manufacturer:
    - 1) HAFELE: #282.24.720.
- 9. Adjustable Shelf Pilaster Standard and Shelf Supports:
  - a. Pilaster Standard shall be KNAPE & VOGT #255, 19-gage x 5/8" wide x 3/16" high.
    - 1) #255-WH (Epoxy-Coated White) at interior cabinet surface locations.
    - 2) #255-BRN (Brown) at exposed cabinet surface locations.
  - b. Shelf Supports shall be KNAPE & VOGT #239 ZC (Zinc Coated).
- 10. Magnetic Catcher:
  - a. AMEROCK: #CM9783-AL.
  - b. Approved equivalent manufacturer:
    - 1) KNAPE AND VOGT: #918-AL.
- 11. Exposed Fasteners: When exposed fasteners are used, provide zinc chromate coated oval head, self-tapping phillips screws with grommet finishing washers, same finish as screws.
- 12. Joint Closure:
  - a. PEMKO: #313AN.
- 13. Exposed Fasteners: When exposed fasteners are used, provide zinc chromate coated oval head, self-tapping phillips screws with grommet finishing washers, same finish as screws.
- 14. Cabinet Catch (only when indicated on the drawings)
  - a. STANLEY #CD34.
- 15. Label Plate:
  - a. HAFELE #168.02.761.
- 16. Grommets, Cable Managers and Cabinet Vents:
  - a. Provide grommets, cable managers and cabinet vents in various sizes, finishes and shapes, as indicated on the drawings and as otherwise required for a complete installation.
  - b. Provide type S/S-3 Grommet for all conditions not noted. Grommets & Air Vents by DOUG MOCKETT & COMPANY, INC., or approved equivalent.
  - c. A partial listing is provided below (for other listings, see the drawings):



**MODULAR CASEWORK**

**2175**

- 1) Wire Manager: #WN-2A.

END OF SECTION

**SECTION 07 18 50 – VAPOR-ALKALINITY CONTROL**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment, testing and services necessary to:
    - a. Completely install all Vapor-Alkalinity Control 100 percent solids epoxy membrane materials, accessories and other related items necessary to control for water vapor and alkalinity in existing or new concrete slabs for the Project.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS (Including BID FORM)
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 09 30 00 TILE
  - 5. 09 68 40 CARPET
  - 6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
- C. Cost of Work:
  - 1. The entire cost for providing the vapor-alkalinity control specified under this Section shall be listed on the BID FORM as a Line Item and included as a part of the Base Bid. Refer to the BID FORM.
  - 2. If it is determined by way of testing, and it is agreed to by the Owner, Architect, Contractor, and the Flooring Installer, that the work of this Section is not required, then this Work (or a portion of this Work agreed to by the Owner, Architect and the Contractor) for the Installation of the Vapor-Alkalinity Control Membrane System will be deleted from the Project by the way of a Change Order, and the Contract Sum shall be reduced accordingly.

**1.2 REFERENCES**

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ACI American Concrete Institute
      - 1) ACI Committee Report 201 "Guide to Durable Concrete"
    - b. ASTM American Society for Testing Materials International

**1.3 DEFINITIONS**

- A. Membrane System: "Water Vapor-Alkalinity Membrane System."
- B. New Concrete Slab: Any concrete slab poured after the signing of the Contract for this Project, regardless of the duration of the construction period.
- C. Existing Concrete Slabs: Any slabs existing (or poured) prior to this Project.
- D. pH: Alkalinity.
- E. RH: Relative Humidity.

- F. MVER: Moisture Vapor Emission Rate.
- G. Hg: Mercury.

#### 1.4 SYSTEM DESCRIPTION

- A. The Moisture Vapor Control System shall be specifically formulated and marketed for concrete floor slab moisture vapor and pH control.
- B. Membrane System Performance Requirements: It is the intention of this section to form a guide for a complete membrane system. Any items not specifically noted but necessary for a complete membrane system shall be provided under this section. Membrane System shall comply with the following:
  - 1. Shall control alkalinity for a long term maximum resistance of pH 14 per pH Testing of ASTM F 710 "Preparing Concrete Floors to Receive Resilient Flooring."
  - 2. Shall control vapor transmission up to and including 100 percent readings per RH Testing of ASTM F 2170 "Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes".
  - 3. Perm Rate Results (net perms - grains /hr/sq.ft. in 1 inch of Hg) of the membrane system shall not exceed:
    - a. New Concrete Slabs: 0.09 grains/sq. ft./hour in 1 inch of Hg or less per ASTM E 96 "Water Vapor Transmission of Materials" per the Water Method for new concrete slabs.
    - b. Existing Concrete Slabs: 0.05 grains/sq. ft./hour in 1 inch of Hg or less per ASTM E 96 "Water Vapor Transmission of Materials" per the Water Method for renovation work on existing slabs.
  - 4. Compatible with all types of floor covering products and systems specified for this project.
  - 5. Independently tested with certified results.
  - 6. Contain no silicate or water/alkaline soluble compounds.
  - 7. Capable of the following in an environment of constant water vapor and water exposure:
    - a. System shall be capable of curing well when water saturation of the surface underneath coatings can begin within a short period of time depending on the amount of osmotic water/moisture permeating through the concrete.
    - b. Rapid adhesion to the substrate without jeopardizing the long term bonding performance.
  - 8. Sufficient density to avoid water vapor damage to other adhered systems.
  - 9. Resistant to most commonly encountered acids/solvents in case of topical exposure (spills).

#### 1.5 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data:
    - a. Manufacturer's Data for each type of product specified.
  - 2. Quality Assurance/Control:
    - a. Test Reports:

- 1) Independent Testing Laboratory test results for RH (relative humidity) in concrete.
    - 2) Independent Testing Laboratory test results for pH on concrete.
    - 3) Contractor test results for Perm Rating of the Membrane System that the net perms test results shall be submitted with verification that lab applied the manufacturer's product to the test samples.
  - b. Manufacturer's Instructions:
    - 1) Written installation instructions.
  - c. Manufacturer's Field Reports:
    - 1) Written field report detailing installation observations.
    - 2) Final field report after curing indicating installation was performed properly.
  - d. Qualification Statements
    - 1) Manufacturer's Membrane System Performance requirement letter.
    - 2) List of Previous Projects.
    - 3) Manufacturer's Installer Certification.
    - 4) Manufacturer's Duration of Experience.
3. Closeout Submittals:
  - a. In accordance with Specification Section – PROJECT CLOSEOUT.
  - b. In accordance with this specification and with Specification Section – WARRANTIES.

## 1.6 QUALITY ASSURANCE

- A. Qualifications:
  1. Material Qualifications:
    - a. All items shall be within the Membrane System Performance Requirements specified earlier within this specification section.
    - b. Provide list of at least three (3) projects available for inspection employing same vapor-alkalinity control system(s) within the last ten (10) years, within the same climate zone.
  2. Installer Qualifications:
    - a. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
  3. Manufacturer's Qualifications:
    - a. Firm regularly engaged in the business and manufacture of vapor emission and alkalinity control installations of similar size and complexity with the system proposed for use, and have had experience for at least ten (10) years of manufacturing water-vapor reduction systems with the product submitted.
- B. In accordance with Specification Section - REGULATORY REQUIREMENTS.
- C. Mock-Up:

1. Install the Moisture Control System in a minimum 100 sq. ft. mock-up area, using the same methods, laborers and equipment that will be used for the entire installation. Test tensile bond strength of the moisture mitigation system to the concrete substrate following ASTM Test Method D 7234. The results shall be equal to or greater than 200 psi with failure in the concrete before proceeding with installation of the moisture control system.

**D. Meetings:**

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - c. Review delivery, storage, and handling procedures.
  - d. Review project conditions.
  - e. Review condition of concrete slabs on grade.
2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
  - b. Maintaining installed work until the Notice of Substantial Completion has been executed.

**1.7 DELIVERY, STORAGE AND HANDLING**

**A. Acceptance at Site:**

1. Products must be in manufacturer's original unopened containers with labels indicating brand name and product name.
2. Damaged products will not be accepted.

**B. Storage and protection:**

1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units, in a locked, clean and neat, well ventilated area.
  - a. Cover material with protective water proof covering providing for adequate air circulation and ventilation.
  - b. Empty containers shall not be removed from the site, unless approved by the Architect.

**1.8 PROJECT CONDITIONS**

**A. Environmental requirements:**

1. Temperature:

- a. Maintain ambient temperature in all spaces to receive independent testing and membrane system installation between sixty-five (65) degrees Fahrenheit and seventy-eight (78) degrees Fahrenheit for seven (7) days prior, during, and after installation.
      - b. Inform the Owner of ambient temperature in space to receive independent testing and membrane system installation and maintain until Substantial Completion and turn-over of the building or facility to the Owner.
    2. Ventilation:
      - a. During membrane system installation provide continuous ventilation and indirect air movement at all times during application and curing process.
  - B. Existing conditions:
    1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
    2. Concrete surfaces shall have cured for not less than twenty-eight (28) days before independent testing.
    3. Not less than seven (7) days shall have passed since surfaces were last wet.
- 1.9 WARRANTY
- A. Contractor's General Warranty:
    1. In accordance with specification section - WARRANTIES
  - B. Manufacturer's Warranty:
    1. In accordance with manufacturer's written standard warranty.
      - a. Manufacturer's warranty shall cover against water vapor transmission or out of range levels of alkalinity failure through concrete slabs and includes all labor and material costs for replacement of all products installed over the membrane system.
      - b. Warranty period Fifteen (15) Years.
  - C. Installer's Warranty:
    1. In accordance with the terms of Specification Section – WARRANTIES:
      - a. Warranty period Five (5) Years.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Membrane System for New Concrete Slabs - Specified product manufacturer:
    - a. KOESTER AMERICAN CORP. "VAP I 2000 SYSTEM"

- b. Approved equivalent manufacturers:
    - 1) ALLIED CONSTRUCTION TECHNOLOGY 2170.
    - 2) MAPEI "Planiseal VS."
  - 2. Membrane System for Existing Concrete slabs - Specified product manufacturer:
    - a. KOESTER AMERICAN CORP. "VAP I 2000FS SYSTEM"
    - b. Approved equivalent manufacturers:
      - 1) ALLIED CONSTRUCTION TECHNOLOGY 2170 Fast Setting Product.
      - 2) MAPEI "Planiseal VS" Fast Setting Product.
  - 3. Core Testing Repair Product:
    - a. CTS CEMENT "RAPID SET CEMENT"
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. General:
  - 1. Membrane System shall be the product of one manufacturer.
- B. Membrane System for New Concrete Slab Substrates: One (1) Coat, epoxy 100 percent solids system, containing specifically formulated chemicals and resins complying with the Performance Requirements specified. No silicate or water based formulations are allowed.
  - 1. Pot Life 12 minutes.
  - 2. Cure-Time 12 hours.
  - 3. Solid Content 100 percent.
  - 4. VOC, mixed Less than 10 g/L.
  - 5. Flash Point Greater than 200 degrees F.
  - 6. Storage Between 50 degrees F - 90 degrees F.
  - 7. Shelf Life 1 Year minimum in original sealed container.
- C. Membrane System for Existing Concrete Slab Substrates: One (1) Coat, epoxy 100 percent solids fast setting system, containing specifically formulated chemicals and resins complying with the Performance Requirements specified. No silicate or water based formulations are allowed.
  - 1. Pot Life 12 minutes.
  - 2. Cure-Time 4 hours.
  - 3. Solid Content 100 percent.
  - 4. VOC, mixed Less than 10 g/L.
  - 5. Flash Point Greater than 200 degrees F.
  - 6. Storage Between 50 degrees F - 90 degrees F.
  - 7. Shelf Life 1 Year minimum in original sealed container.

## 2.3 ACCESSORIES

- A. Bonding Material (if required): Provide membrane manufacturer's written recommended bonding emulsion materials compatible with the membrane system.

- B. Crack and Joint Filler:
  - 1. Provide membrane system manufacturer's written recommended crack and joint materials compatible with the membrane system.

## 2.4 MIXES

- A. Vapor-Alkalinity Control Membrane System:
  - 1. Use clean containers.
  - 2. Mix thoroughly as per manufacturer's written requirements to obtain a homogeneous mixture.
    - a. Use a low speed motor less than 400 rpm and a two bladed "jiffy mixing blade" only. DO NOT AERATE! Mix ratios are measured by volume.
    - b. Specified membrane system shall have its components mixed at a ratio of 2.4:1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Preparation shall not begin until the Owner, Architect, and Contractor have reviewed independent testing laboratory results of Alkalinity and Relative Humidity testing and have informed the membrane system manufacturer and installer of areas where the membrane system is to be installed.
  - 2. Prior to the execution (preparation) of the work under this specification section, the Owner's representative shall inspect the installed work executed under other sections of this Project Manual that affect the execution of work under this specification section.
    - a. Membrane System Installer to investigate and inform the membrane system manufacturer if Alkali-Silica Reaction is present, and/or oil contamination, concrete additives (using chlorides), or any other soluble compounds that can contaminate surfaces have been used in any concrete mix, or is present in the existing concrete substrate.
  - 3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 4. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of the surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Comply with ASTM F 3010 "Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings."



2. After the Testing Laboratory removal of all RH probes, fill all RH Test holes with core repair product in accordance with membrane manufacturer's written recommendations, and allow curing before any other cleaning occurs.
3. Clean all surfaces to receive membrane system.
4. "Shotblast" all floors and clean surfaces with a dust contained vacuum to remove all residue off the substrate to a minimum CSP (Concrete Surface Profile) of 3. Shotblast existing areas to a minimum of CSP 4. Systems introducing water or acids to the floor systems (such as "Hydrablasting" or "Acid Etching") are NOT ALLOWED.
  - a. Grinding floor areas is only allowed when floor areas are inaccessible by "Shotblasting".
    - 1) Grind to a CSP as recommended in writing by the membrane system manufacturer, but in no cases less than 3.
      - a) Existing slabs shall be no less than 4.
    - 2) Where surface profiles require (because of silicate or other bond breaker film applications), grind to a higher level of CSP, as required in writing by the membrane system manufacturer for removal of film items not compatible with the system membrane.
  - b. Protect electrical or mechanical equipment items in place from dust and particulate residue that could impede their proper operation.
  - c. Remove ALL defective materials and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance, "shotblast" bb's, etc.
  - d. Remove, after "shotblasting," leaving no reinforcing fibers (if any) left on the concrete surfaces.
    - 1) Reinforcing fibers must be burned off, scraped and vacuumed.
5. Repair all cracks, expansion joint, control joints, and open surface honeycombs and fill in accordance with crack and joint filler manufacturer's written recommendations.
  - a. Mix with silica sand for large cracks or voids.
6. Provide an uncontaminated, absorptive, sound surface.

### 3.3 APPLICATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Verify that required repairs and fills are complete, cured, and dry before application.

#### B. Assistance:

1. Application shall be in direct consultation and review of manufacturer's representative.

#### C. System Application:

1. The coverage rate for the provided system shall be based on the surface texture and porosity of the substrates as well as the measured level of moisture from the examination of the substrates after surface preparation, and in accordance with manufacturer's written instructions. Approximate minimum coverage of the specified membrane system relative to existing levels of moisture vapor after surface preparation are as follows:
  - a. New concrete slabs 150 sq. ft. / gal.
  - b. Existing concrete slabs 130 sq. ft. / gal.
  - c. Apply one coat of the specified system at the written recommended rates (see above) using a squeegee and or a 3/8 inch nap roller leaving NO areas untreated.
  - d. Allow the substrate to cure a minimum of:

- 1) New concrete slabs: 12 hours before installing underlayment or flooring system.
- 2) Existing concrete slabs: 4 hours before installing underlayment or flooring system.

### 3.4 FIELD QUALITY CONTROL

#### A. Site Tests:

1. Prior to the execution (preparation) of the work of this specification section, the Project Inspector will arrange with the Independent Testing Laboratory to perform the following tests:
  - a. Alkalinity Testing per ASTM F 710 "Preparing Concrete Floors to Receive Resilient Flooring."
  - b. Relative Humidity Testing per ASTM F 2170 "Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes."
2. Test only concrete slabs scheduled to receive floor coverings.
3. Test only when concrete floor slabs have cured a minimum of 28 days.
4. Test only when the concrete slabs have been acclimated to final environmental conditions as specified in the Article PROJECT CONDITIONS within this Specification Section.

#### B. Inspection:

1. Schedule inspections and notify the Architect, Project Inspector, and any other regulatory agencies of the time at least 48 hours prior to the inspection.
2. No work shall proceed without the inspections of the Project Inspector.

#### C. Manufacturer's Field Services:

1. Membrane System Manufacturer shall field verify and report on observations of system application per manufacturer's recommendations during installation.
2. Membrane System Manufacturer shall issue a Final Field Report, after curing, indicating installation was completed per manufacturer's recommendations.

### 3.5 CLEANING

#### A. Cleaning:

1. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
2. Clean any soiled surfaces immediately.
3. Remove all debris resulting from specified system installation from project area.
4. Finish shall be clean and ready for the application of any additional finishes.
5. Clean all tools and equipment as recommended in writing by the manufacturer.

### 3.6 PROTECTION

#### A. Protection:

1. Protect membrane system during specified cure periods from any kind of traffic, topical water, and contaminants.

END OF SECTION

## SECTION 07 21 00 – INSULATION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
- B. Provide all material, labor, equipment and services necessary to completely install all Insulation, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 06 17 33 WOOD JOISTS
  - 5. 07 40 00 METAL PANELS
  - 6. 07 51 13 BUILT-UP ROOFING
  - 7. 07 60 00 SHEET METAL
  - 8. 08 11 00 METAL DOORS AND FRAMES
  - 9. 09 24 00 CEMENT PLASTER
  - 10. 09 29 00 GYPSUM BOARD
  - 11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 12. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. MIMA Mineral Insulation Manufacturers Association
    - b. NFPA National Fire Protection Association
    - c. TIMA Thermal Insulation Manufacturers Association

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Product Data on materials and accessories.
  - 2. Quality Assurance/Control Submittals:
    - a. Manufacturer's Written Instructions:
      - 1) Submit three (3) copies of manufacturer's written instructions.
  - 3. Closeout Submittals in accordance with the following:
    - a. Warranty in accordance with Specification Section - WARRANTIES.

## 1.4 QUALITY ASSURANCE

- A. In accordance with California Quality Standards.
- B. The R values for the insulation materials shall be in accordance with "The Standard Mineral Wool Building Insulation" latest Edition of the MIMA.
- C. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. ASTM American Society for Testing and Materials

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage of Materials:
  1. All Materials shall be delivered and stored in original unopened packages with manufacturer's name and contents legibly indicated. Materials shall be stored in a dry place, and protected from damage.

## 1.6 WARRANTY

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES
    - a. Warranty Period One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Specified blanket insulation product manufacturer:
    - a. OWENS CORNING
    - b. Acceptable alternative manufacturers:
      - 1) CERTAINTEED
      - 2) JOHNS MANVILLE CORPORATION
  2. Specified sound blanket insulation product manufacturer:
    - a. OWENS CORNING
    - b. Acceptable alternative manufacturers:
      - 1) CERTAINTEED
      - 2) JOHNS MANVILLE CORPORATION
  3. Specified draft stop insulation product manufacturer :
    - a. THERMAFIBER "Thermafiber."
  4. Specified foundation insulation product manufacturer:
    - a. DOW CHEMICAL COMPANY "Styrofoam."
  5. Specified rigid roof board insulation product manufacturer:
    - a. SARNAFIL "Sarnatherm ISO."

- b. Acceptable Alternative Manufacturers:
      - 1) ATLAS.
      - 2) JOHNS MANVILLE CORPORATION.
      - 3) TREMCO.
  - 6. Please add Specified Poultry Netting back into Spec. Specified welded stud stick pins and self-locking washers product manufacturer or approved equivalent:
    - a. SUNBELT STUD WELDING.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Thermal Blanket:
  - 1. Construction in accordance with the following:
    - a. Type I: Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with a maximum flame-spread and smoke-developed indices of 25 and 50, respectively, per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials"; passing ASTM E 136 "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C," for combustion characteristics.
      - 1) Unless otherwise noted, blankets without vapor-retarder membrane coverings, used in Interior partitions not subject to moisture.
    - b. *not used*
    - c. *not used*
  - 2. Thermal Resistance (R) values required (minimum) for blanket insulation, unless otherwise indicated on the drawings:
    - a. *not used*
    - b. Wall Blanket Insulation: R-19.
    - c. *not used*
    - d. *not used*
  - 3. Thickness: No more than will fit into the space available without compressing. Where insulation is confined between finishes, which would compress the material, high efficiency insulation shall be used to provide the required resistance value.
- B. Sound Blanket:

1. Sound Attenuation Batts, unfaced, as manufactured by OWENS CORNING ECOTOUCH SOUND ATTENUATION BATTS, 2-1/2" batts for wood or metal frame construction, complying with ASTM C 665 "Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type I, and ASTM E 136 "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C."
  - a. Flame Spread Index Maximum 25.
  - b. Smoke Developed Index Maximum 50.
- C. Draft Stop:
  1. 2" minimum to 4" thick Safing Insulation, as required on the drawings. Provide manufacturer's written recommended fasteners as required for the specific installation requirements.
    - a. Flame Spread and Smoke Developed Index maximum as follows in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
      - 1) Unfaced Safing Insulation:
        - a) Flame Spread Index 15
        - b) Smoke Developed Index 0.
      - 2) Foil Faced Safing Insulation:
        - a) Flame Spread Index 25
        - b) Smoke Developed Index 5.
- D. Foundation:
  1. *not used*
    - a. *not used*
    - b. *not used*
- E. Rigid Board:
  1. Roof Board:
    - a. In accordance with:
      - 1) ASTM C 1289 "Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board," Type 2, Class 1, isocyanurate with front and back glass fiber/organic mat paper-facers (balanced panel), conditioned "R" value of 8.6 per 1.5 inches minimum, in accordance with ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials," and ASTM D 1621 "Test method for Compressive Properties of Rigid Cellular Plastics."
        - a) Flame Spread Index Maximum, core: 25 or less.
        - b) Smoke Density Developed Index Maximum, core: 450 or less.
        - c) Compressive strength: 20 PSI.
        - d) 4' x 4' or 4' x 8' panels.

## 2.3 ACCESSORIES

- A. Staples:
  1. Hammer type.

- B. Wire:
  - 1. Sixteen (16) gage line wire.
- C. All other materials such as fasteners (i.e. insulation netting, line wires, stick-pins), and retainers not specifically described, but required to complete the work, shall be as recommended by approved manufacturer, and installed by the Contractor. Contractor shall choose the appropriate fastener or system for the cavity space or area to be insulated without letting the insulation sag.
  - 1. Poultry Netting: As distributed by INSULATION MATERIALS.
    - a. 2" hexagonal, 20 gage galvanized in rated assemblies.
  - 2. FSK Tape: As distributed by INSULATION MATERIALS.
    - a. VENTURE TAPE product #1525CW.
  - 3. *not used*
    - a. *not used*
    - b. *not used*
    - c. *not used*
    - d. *not used*
    - e. *not used*

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  - 1. All building(s) shall have a complete thermal envelope of thermal blanket or rigid board insulation.
    - a. Do not install insulation until the construction has progressed to the point that inclement weather will not damage or wet the insulation material.
    - b. Install in accordance with manufacturer's written recommendations.
    - c. Insulation shall fit snugly between framing members without voids. Fully insulate all areas between all framing members, cutting and fitting as required.
    - d. Attach insulation to inside face of framing members.
      - 1) Wood Framing: Friction fit to keep from falling down within wall cavity. Attach with Hammer Staples at 6 inches on center with minimum staple penetration of 3/8 inch when insulation has a membrane facing.
      - 2)
    - e. Vapor-Retarder Membrane: Shall be continuous and without unnecessary joints.

- 1) At roof structure and exterior walls, after securing the insulation facing flanges, provide FSK Tape over all of the insulation facing butt joints and all overlapping facing flanges, so as to create a continuous vapor-retarder membrane at underside of the roof deck and inside of walls.
  - 2) Patch all tears, rips and holes in the vapor-retarder membrane.
  - f. Cut and fit insulation material around pipes, conduits and outlet boxes, as necessary to maintain the full integrity of the insulation.
- B. At Roof Framing:
1. Install thermal roof blanket Insulation between all exterior roof framing members.
    - a. Wood Framing: Attach wire to framing with staples with minimum staple penetration of 5/8 inch.
    - b. Metal framing: Attach with line wires perpendicular to framing at 12 inches on center.
- C. At Wall Framing: Install thermal wall blanket insulation between all exterior wall framing members.
- D. At Floor Framing: Install thermal floor blanket insulation between all exterior floor framing members.
- E. Sound Insulation:
1. Install sound attenuation batts between all interior wall framing members.
  2. Install sound attenuation batts between all floor framing members.
  3. Install sound deadening board over interior wall framing members.
- F. Draft Stop Insulation:
1. Install Draft Stop Insulation where required.

END OF SECTION



## SECTION 07 40 00 – METAL PANELS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
  - 2. This Section includes:
    - a. Metal Roof Panels (Sloped Roof Panels)
    - b. Metal Wall Panels
    - c. Sun Shades and Wall Accents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 07 21 00 INSULATION
  - 5. 07 51 13 BUILT-UP ROOFING
  - 6. 07 60 00 SHEET METAL
  - 7. 07 72 00 ROOF ACCESSORIES
  - 8. 09 91 00 PAINTING
  - 9. 11 66 43 SCOREBOARDS
  - 10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following Standards:
    - a. AAMA American Architectural Manufacturers Association
    - b. AATCC American Association of Textile Chemists and Colorists
    - c. AISC American Institute of Steel Construction.
    - d. FMG Factory Mutual Guide (Wind Uplift Requirements for FMG 1A- 90 minimum for Metal Roof Panels), or UL Equivalent.
    - e. ICC International Code Council (Formerly ICBO)
    - f. MBMA Metal Building Manufacturers Association, "Metal Roofing Systems Design Manual".
    - g. NAAMM National Association of Architectural Metal Manufacturers.
    - h. SMACNA Sheet Metal and Air Conditioning Contractors National Association.
    - i. TAPPI Technical Association of the Pulp and Paper Industry, Inc.
    - j. UL Underwriters Laboratories (FMG Equivalent for some manufacturers).

## 1.3 DEFINITIONS

- A. The following definitions apply to this specification section:

1. Waterproof: Any material, treatment, or construction that resists flow or penetration of water (Means Illustrated Construction Dictionary, Third Edition, Unabridged)
2. Weathertight: Generally meaning the ability of the roofing system (including all roof panels, side seams, end laps, roof to wall flashing, ridge flashing, hip flashing, valley flashing, high side eave flashing, rake flashing, expansion joints, curb and penetration flashing, gutters, and wall panels) to prevent water intrusion under normal climatic conditions (including wind and snow conditions) for the area where the project is constructed.
  - a. Also, the word "Weathertightness" is a variation of the word "weathertight" and shall have the same definition applied. (Definition obtained from various manufacturers warranty literature.)

#### 1.4 SYSTEM DESCRIPTION

- A. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
  1. General: Provide metal panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 "Test method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems" at the following test-pressure difference:
  1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft.
  2. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft.
  3. Positive Preload Test-Pressure Difference:
    - a. Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
  4. Negative Preload Test-Pressure Difference:
    - a. 50 percent of design wind-uplift-pressure difference.
- C. Water Penetration: No water penetration when tested according to ASTM E 1646 "Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference" at the following test-pressure difference:
  1. Test-Pressure Difference: 2.86 lbf/sq. ft. for roof slopes less than or equal to 30 degrees.
  2. Test-Pressure Difference:
    - a. 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. and not more than 12.0 lbf/sq. ft. for roof slopes steeper than 30 degrees.
  3. Positive Preload Test-Pressure Difference:
    - a. Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
  4. Negative Preload Test-Pressure Difference:
    - a. 50 percent of design wind-uplift-pressure difference.
- D. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
  1. Fire/Windstorm Classification: Class 1A-90.
  2. Hail Resistance: MH Moderate Hail.
  3. Hail Resistance: SH Severe Hail.

- E. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 "Test method for Structural Performance of Sheet metal Roof and Siding Systems by Uniform Static Air Pressure Difference" or UL 580 "Safety Testing for Uplift Resistance of Roof Assemblies."
  - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    - a. Uniform pressure as indicated on Drawings.
  - 2. Deflection Limits: Engineer metal roof panel assemblies to withstand design loads with vertical deflections no greater than 1/180 of the span.
- F. Seismic Performance: Provide metal roof panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, and CBC Chapter 13.
- G. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 1.5 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Coordination Drawings: Roof plans and Wall Elevations drawn to scale, coordinating penetrations and roof-and/or wall-mounted items. Show the following:
    - a. Roof panels and attachments.
    - b. Purlins and Rafters.
    - c. Wall Panels and attachments.
    - d. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
    - e. Wall-mounted items including supports, pipe supports and penetrations.
  - 2. Product Data.
    - a. Material List and product information regarding material composition, product names, profiles, shapes, finishes, and application for each item.
    - b. Submit manufacturer's standard color range for selection by the Architect.
    - c. Submit manufacturer's full color range (including any standard, premium and custom colors) of all metal panels and exposed components for selection by the Architect.
  - 3. Shop Drawings.
    - a. Submit shop drawings and Structural Calculations prepared by the manufacturer under the supervision of a registered Civil or Structural Engineer in the State of California, detailing fabrication and assembly of the work under this section, as well as procedures and diagrams. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorage to be installed as unit of work of other related sections.
      - 1) Manufacturer shall prepare, review and approve all drawings and shop drawings prior to submittal to the Architect.
        - a) Calculations shall include design wind load pressures for components and cladding (walls and roofs) in accordance with CBC 1609A.
        - b) Calculations shall also include checks for panel spans between attachment points.
        - c) Check of attachment hardware to panel.
        - d) Check of fasteners connecting panel hardware to structure,

- 2) Manufacturer shall approve of all details (including Architects standard details) prior to fabrication. If different details than the Architects details are required to satisfy manufacturers warranty requirements, submit the differences (highlighted as to differences) to the Architect for review.
  - 3) Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, lap seams, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
  - 4) Include details of the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches:
    - a) Flashing and trim.
    - b) Gutters.
    - c) Downspouts.
    - d) Roof curbs.
4. Samples.
- a. For each type of exposed finish required, prepared on Samples of size indicated below.
    - 1) Metal Panels: Provide 12 inches long by actual panel width.
    - 2) Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
    - 3) Roof Underlayment: 6 inch square samples.
    - 4) Vapor Retarders: 6 inch square samples.
    - 5) Water Barriers: 6 inch square samples.
    - 6) Accessories: 12 inch long samples for each type of accessory.
    - 7) Provide two (2) fasteners with any neoprene washers, metal washers, nuts or rivets for every type of fastener condition on this Project. Tag and label each fastener indicating that location and use for each fastener condition on this project.
5. Quality Assurance/Control Submittals:
- a. Installer Qualifications:
    - 1) Submit three (3) copies of manufacturer's Installer Certification.
  - b. Manufacturer's Written Instructions:
    - 1) Submit three (3) copies of manufacturer's written instructions.
  - c. Manufacturer's Field Reports:
    - 1) Submit three (3) copies of manufacturer's field reports.
  - d. Manufacturer's Test Reports:
    - 1) Provide Test Reports per ASTM E 1592, FM 4474, UL 580, and DSA IR A-5.
  - e. Engineering Calculations:
    - 1) Submit four (4) copies of engineering calculations computed and signed by a registered Civil or Structural Engineer in the State of California.
6. Closeout Submittals in accordance with the following:
- a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Project Record Documents in accordance with Specification Section - PROJECT RECORD Documents.
  - c. Warranty in accordance with Specification Section - WARRANTIES.
    - 1) Special Warranties:
      - a) Twenty (20) Year Weather Tightness Warranty.
      - b) Five (5) Year Installation Warranty.
      - c) Twenty (20) Year Finish Warranty.

## 1.6 QUALITY ASSURANCE

## A. Qualifications:

## 1. Installer Qualifications:

- a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
  - 1) Installer shall have manufacturers signed Certified Installer Agreement as a rider to the warranty.

## 2. Manufacturer/Supplier Qualifications:

- a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- b. Manufacturer shall inspect during installation and after completion and report to the Architect.
  - 1) A factory trained representative approved by the manufacturer shall visit the project site a minimum of five (5) times, in order to review the installation of the metal panels, and provide a follow-up written report for the following periods in the construction schedule.
    - a) At the preliminary metal panel conference.
    - b) During the first week of installation, in order to review the installation requirements.
    - c) When the metal panel installation is approximately 50% complete
    - d) Upon completion of the metal panel installation.
    - e) When punch list and corrections have been completed

## B. Regulatory Requirements In accordance with Specification Section - REGULATORY REQUIREMENTS.

## C. Meetings:

1. Preliminary Metal Panel Conference: Before starting roof deck and wall panel, sheathing, wood joists or purlin and rafter construction, conduct conference scheduled by the Contractor at Project site. Review methods and procedures related to roof construction and metal roof panels including, but not limited to, the following:
  - a. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal panel installer, metal panel manufacturer's representative, deck, sheathing, wood joists or purlin and rafter installer, and installers whose work interfaces with or affects metal panels including installers of metal panel accessories and roof-mounted equipment.
    - 1) Review wood blocking layout (if any) required for metal panel fastener / anchorage system.
  - b. Coordinate the work with all other related work.
  - c. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - d. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
  - e. Examine conditions for compliance with requirements, including flatness and attachment to structural members.
  - f. Review structural loading limitations of metal panel substrate construction during and after roofing and wall construction.

- g. Review metal panel flashings, special metal panel details, metal panel drainage, metal panel penetrations, equipment curbs, and condition of other construction that will affect metal panels.
  - h. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
  - i. Review temporary protection requirements for metal panels during and after installation.
  - j. Review metal panel observation and repair procedures after metal panel installation.
  - k. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
- 2. Progress Meetings: Scheduled by the Contractor for the proper performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule of necessary.
- 3. Final Inspection: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
  - b. Maintain installed work until the Notice of Substantial Completion has been executed.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect strippable protective covering on metal panels from exposure to sunlight and high humidity, except to extent necessary for period of metal panel installation.

#### 1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of metal panel framing and metal panel opening dimensions by field measurements before metal panel fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field-trimming of panels. Coordinate metal panel construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

## 1.9 SEQUENCING AND SCHEDULING

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Specification Section - ROOF ACCESSORIES.
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of metal panel substrate, parapets, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
  - 2. Installer shall have manufacturers signed Certified Installer Agreement as a rider to the warranty.
- B. Manufacturer's Warranty:
  - 1. Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
    - a. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244 "Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Coordinates."
      - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214 "Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films."
      - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
    - b. Finish Warranty Period: 20 years from date of Substantial Completion.
      - 1) All costs for Warranty shall be included in the bid price. There shall be no additional costs associated with the implementation or maintaining of the warranty.
  - 2. Weathertightness Warranty for Standing-Seam Metal Roof Panels:
    - a. Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
      - 1) Warranty shall include roof panel side seams, end laps, roof to wall flashing, ridge flashing, hip flashing, valley flashing, high side eave flashing, rake flashing, approved expansion joints, approved curb and penetration flashing, approved gutters and built-in gutters, and approved wall systems.
      - 2) A Factory trained manufacturer representative approved by the manufacturer shall inspect during and at completion of installation and certify that the system is acceptable to the manufacturer's weathertightness standards.
    - b. Warranty Period: 20 years from date of Substantial Completion.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES
    - a. Warranty Period Five (5) years.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified Flat Sloped Roof Panel (Standing Seam) product manufacturer:
    - a. NCI (CENTRIA) "SRS-3." TB-96-07 Rev4.
    - b. Acceptable alternative manufacturers:
      - 1) GARLAND "R-MER SPAN." R18494.
      - 2) T-ARMOR PANEL (METAL SALES) "MESA." ESR3743
  2. Specified Wall Panel product manufacturer:
    - a. NCI (CENTRIA) (Inverted Box Rib) IBR5-36.
    - b. Acceptable alternative manufacturers:
      - 1) AEP SPAN REVERSED BOX RIB.
  3. Specified Roof Underlayment product manufacturer:
    - a. TYPAR ROOF WRAP 30.
  4. Specified Water Barrier (also qualifies as an "Air Barrier"):
    - a. TYVEK COMMERCIAL WRAP.
    - b. Acceptable alternative manufacturers:
      - 1) TYPAR METRO WRAP.
  5. Specified Ice and Water Shield:
    - a. GCP APPLIED TECHNOLOGIES; CE and WATER SHIELD HT.
      - 1) Formerly GRACE CONSTRUCTION PRODUCTS.
    - b. Acceptable alternative manufacturers:
      - 1) CARLISLE COATINGS & WATERPROOFING CCW WIP 300HT.
  6. Specified Insulation:
    - a. Acoustical Fiberglass OWENS-CORNING FIBERGLASS.
    - b. Rigid Board RMAX - "RE-COVER BOARD-3."
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Properties:
1. Panels: Metallic-Coated Steel Sheet Prepainted with Coil Coating composed of steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755 "Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products." See Schedule Article at the end of this section for profiles and manufacturer/product names, gages, application and finish requirements.
    - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," G90 coating designation; structural quality.

-or-



- b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792 "Standard Specification for Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process," Class AZ50 coating designation, Grade 50; structural quality.
  - 2. Flashing and Trim: Formed from zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet (minimum thickness and material to match gage of Metal Panels, unless noted otherwise) pre-painted with coil coating. Provide custom profile shape flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fascia, and fillers. Finish flashing and trim with same finish system as adjacent metal panels. All pieces shall have self-hemmed edges fully pre-finished. No raw or field painted cut-edges will be permitted.
    - a. Provide components required for a complete metal panel assembly including trim, copings, fascia, corner units, closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels, unless otherwise indicated.
    - b. Exactly matching materials, gage of Metal Panels, profile, texture and pre-finish.
    - c. Supply in continuous lengths as long as possible with minimal seams the full extent of the roof.
    - d. As required for a pre-finished, weathertight assembly.
    - e. All metal work that comes in contact with and/or is an accessory to the metal panels shall be provided and installed by the Metal Panel Manufacturer from the same materials as the Metal Panels.
    - f. Mylar-Coated Tape: 1/4 inch x 1 inch with PSA one side and Mylar one side where required by the manufacturer.
- B. Vapor Retarder: Provide GRIFFOLYN "T-65."
  - 1. Performance Requirements:
    - a. Water Vapor Permeance 0.038 grams/hr·ft<sup>2</sup>·in·Hg.
      - 1) Per ASTM E-96 "Standard Test Methods for Water Vapor Transmission of Materials".
  - 2. Accessories:
    - a. Seam Tape GRIFFOLYN "FAB TAPE."
    - b. Repair Tape GRIFFOLYN "GRIFF-TAPE."
- C. Roof Underlayment: Provide "TYPAR ROOF WRAP 30" with compatible lap seam tape, or approved equivalent.
  - 1. Performance Requirements:
    - a. Gurley Hill (TAPPI T-460): Greater than 2500 sec/100cc.
    - b. Water Vapor Transmission per ASTM E-96 "Standard Test Methods for Water Vapor Transmission of Materials," Method A:
      - 1) Greater than 13 perms.
    - c. Water Penetration Resistance per AATCC-127: 165 cm on Hydrostatic Head.
    - d. Trapezoidal Test per ASTM D 5733 "Standard Test Method for Tearing Strength of Nonwoven Fabrics by the Trapezoid Procedure":
      - 1) Equal to 68 / 67.
- D. Water Barrier (also qualifies as an "Air Barrier"): Provide "TYVEK" "Commercial Wrap" with compatible lap seam tape, or approved equivalent, that complies with 60 Water Resistant, Grade D, in accordance with CBC Sections 1404.2 and 2510.6.
  - 1. Provide manufacturer's preformed tape and recommended cap fasteners for attachment.
  - 2. Seam and Repair Tape: DUPONT "TYVEK 3" WIDE TAPE."

- E. Ice and Water Shield: Self-Adhering, Polyethylene-Faced Sheet, ASTM D 1970 "Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection," 40 mils thick minimum, elongation from 250 percent to 300 percent, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.
- F. Insulation:
1. Acoustical Fiberglass: ASTM C 665 "Standard Guide for Determination of the Thermal Resistance of Low-Density Blanket-Type Mineral Fiber Insulation," type indicated below; consisting of fibers manufactured from glass, Class 1, sized to fit the interior liner panel profile.
    - a. Type I (blankets without membrane covering), passing ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C," for combustion characteristics.
  2. Rigid Board (1-1/2 inch thick minimum unless otherwise noted):
    - a. Between framing members.
      - 1) In accordance with ASTM C 1289 "Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board," Type II, Class 1, isocyanurate with top and bottom surface glass fiber/organic mat facer on both sides (balanced panel), conditioned "R" value of 5.70 per inch.
        - a) Flame Spread Index: 0 - 25, in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials."
        - b) Smoke Density Developed Index: 0 - 450 in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials."
        - c) Compressive Strength: 20 PSI, in accordance with ASTM D 1621 "Standard Test Method for Compressive Properties Of Rigid Cellular Plastics."
        - d) 4' x 4' or 4' x 8' panels.
- G. Furring:
1. General: Comply with ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products" for conditions indicated.
    - a. Steel Sheet Components: Complying with ASTM C 645 "Standard Specification for Nonstructural Steel Framing Members" requirements for metal and with ASTM A 653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process," G60, hot-dip galvanized zinc coating.
  2. Hat Channels (Subgirts): In accordance with ASTM C 645 "Standard Specification for Nonstructural Steel Framing Members."
    - a. Minimum Base Metal Thickness: Appropriate to depth indicated.
    - b. Depth: As indicated.
  3. Cold-Rolled Channels: Thickness appropriate to span, bare steel with minimum 1/2-inch-wide flange.
    - a. Depth: As indicated.
    - b. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0747 inch.
    - c. Tie Wire: ASTM A 641 "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire," Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
  4. Zee Channels:
    - a. At Roofs: Provide in depth as indicated.

- b. At Walls: Provide in depth as indicated.
  - 1) Zee Channels: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.059 inch, and depth required to fit insulation thickness indicated.

## 2.3 ACCESSORIES

- A. Profile Closures:
  - 1. Metal: Exposed To View:
    - a. Provide metal closures, fabricated of same metal as metal roof panels.
  - 2. Neoprene: Concealed from view:
    - a. Provide closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction and to prevent nesting of birds or insects.
- B. Clips: Minimum 0.0598-inch-thick, Galvanized or stainless steel panel clips per manufacturer's written recommendations (stainless steel clips only for aluminum or stainless panels) designed to withstand negative-load requirements.
  - 1. Compatible material and size with Standing Seam Roof System.
- C. Cleats: Mechanically seamed cleats formed from minimum 0.0359-inch-thick, stainless-steel.
- D. Backing Plates: Provide metal backing plates at panel end splices, fabricated from non-corrosive material recommended in writing by manufacturer.
- E. Sealants:
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
  - 2. Joint Sealant: ASTM C 920 "Standard Specification for Elastomeric Joint Sealants"; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
  - 3. Butyl-Rubber-Based, Solvent-Release Sealant: In accordance with ASTM C 1311 "Standard Specification for Solvent Release Sealants."
- F. Fasteners:
  - 1. Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating.
    - a. Fasteners for Metal Panels: Self-drilling or self-tapping type 304 stainless hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal roof panels.
    - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
      - 1) Blind Fasteners: Stainless Steel Blind Rivets.
    - c. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
    - d. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
  - 1. Fabricate panels in longest practical lengths possible (20 foot minimum) to minimize seaming and lapping. See drawings for Curved Roof panel lengths for longer length and lapping requirements.
  - 2. Sound Control: Where sound-absorption requirements are indicated for liner panels, fabricate with 1/8 inch diameter holes at 3/8" o.c. staggered with a 10 percent free area.
- B. Provide panel profile, including major ribs for full length of panel.
- C. Fabricate metal panel joints with factory-installed butyl sealant that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- D. Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 3. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
  - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Exterior Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings for all exterior metal panels.

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces (both sides of panel when both sides are exposed to view) to comply with coating and resin manufacturers' written instructions.
  - a. Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with physical properties and coating performance requirements of ASTM D 2247 "Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity," except as modified below:
    - 1) Humidity Resistance: 2000 hours.
    - 2) Water Resistance: 2000 hours.
2. Durability: Provide coating field tested under normal range of weather conditions for a minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of a chalk rating of 8 according to ASTM D 4214 "Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films"; and without fading in excess of 5 Hunter Units.
3. Color: "Custom Colors" as selected by the Architect.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of work.
  1. Examine primary and secondary metal panel framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal panel manufacturer.
  2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
  1. When applying Ice and Water Shield products, clean and prime the substrates in accordance with the manufacturer's written recommendations.
- B. Install flashings and other sheet metal to comply with requirements specified in Specification Section SHEET METAL flashing and trim.
- C. Install fascia and copings to comply with SMACNA requirements specified in Specification Sections - SHEET METAL and ROOF ACCESSORIES.

- D. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous metal panel support members and anchorage according to metal panel manufacturer's written recommendations.

### 3.3 INSTALLATION

A. Roof Panel Installation:

1. Metal Roof Panel over Wood Roof Deck:
  - a. Place the roof underlayment on wood roof decks. Lap roof underlayment joints 6 inches minimum and adhesively attach in accordance with roofing manufacturer's written recommendations and in accordance with manufacturer's warranty requirements, to provide a continuous uninterrupted membrane. Tape all joints with compatible tape as recommended by the manufacturer. Repair any holes or damage to roof underlayment with compatible repair tape.
  - b. All fastening shall be done in accordance with FMG 1A-90 and manufacturer's written recommendations for the type of panel and fastening system required.
    - 1) Submit fastening schedule along with all shop drawings showing the type of fastener and the spacing required.
    - 2) Structural Fastening:
      - a) Attach clips to plywood with #10-12 pancake phillips head screws, 1-inch long.
      - b) Do not overdrive fasteners into plywood substrate.
2. Metal Roof Panel Installation:
  - a. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
    - 1) Provide Ice and Water Shield at all eaves, ridges, hips, valleys & gutters in accordance with roof panel manufacturer's written recommendations.
    - 2) Field cutting of metal panels by torch is not permitted.
    - 3) Install panels perpendicular to purlins.
    - 4) Rigidly fasten ridge end of flat sloped metal roof panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
    - 5) Provide metal closures at peaks, rake edges, rake walls and each side of ridge and hip caps.
    - 6) Flash and seal metal panels with profile closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
    - 7) Locate and space fastenings in uniform vertical and horizontal alignment.
    - 8) Install ridge and hip caps as metal panel work proceeds.
    - 9) All panels shall be fabricated in continuous lengths whenever possible to eliminate lap seams. When lap seams are unavoidable, locate panel splices over, but not attached to, structural supports. Locations of lap seams shall be submitted to the Architect for review as part of the submittal process. Panels that require lap seams shall be in the longest possible lengths to minimize the overall number of lap seams per roof area.
      - a) Provide ice and water shield at all lap joints in accordance with metal roof panel manufacturer's written recommendations for a watertight seal. Follow manufacturer's cleaning and priming recommendations prior to application of this product.
      - b) Length of lap seals shall be in accordance with manufacturer's warranty requirements for watertight seals.
  - 10) Lap metal flashing over metal panels to allow moisture to run over and off the material.

3. Fasteners:
    - a. Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
  4. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
  5. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.
    - a. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
    - b. Prepare joints and apply sealants to comply with requirements in Specification Section - SEALANTS.
- B. Exterior Wall Panel System:
1. Wall Panel Installation over Metal Framing:
    - a. Place the one layer of the water barrier on wall framing. Lap water barrier joints 6 inches minimum and adhesively attach in accordance with water barrier manufacturer's written recommendations and in accordance with manufacturer's warranty requirements, to provide a continuous uninterrupted membrane. Tape all joints with compatible tape. Repair any holes or damage with compatible tape.
    - b. Provide metal wall panels of full length from sill to top plate, unless otherwise indicated or restricted by shipping limitations. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  2. Fasteners:
    - a. Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.
      - 1) All fastening shall be done in accordance with the drawings and manufacturer's written recommendations for the type of panel and fastening system required.
        - a) Submit fastening schedule along with all shop drawings showing the type of fastener and the spacing required.
        - b) Locate and space fastenings in uniform vertical and horizontal alignment.
    - b. Field cutting of metal wall panels by torch is not permitted.
      - 1) Install panels perpendicular to wall blocking or subgirts.
      - 2) Provide metal and neoprene closures at bottom and top of metal wall panels.
      - 3) Flash and seal metal wall panels with weather closures at perimeter of all openings. Fasten with self-tapping screws.
      - 4) Locate and space fastenings in uniform vertical and horizontal alignment.
      - 5) All panels shall be fabricated in continuous lengths whenever possible to eliminate lap seams. When lap seams are unavoidable, locate panel splices over, but not attached to, structural supports. Locations of lap seams shall be submitted to the Architect for review as part of the submittal process. Panels that require lap seams shall be in the longest possible lengths to minimize the overall number of lap seams per wall area.
        - a) Length of lap seals shall be in accordance with manufacturer's warranty requirements for watertight seals.
      - 6) Lap metal flashing over metal wall panels to allow moisture to run over and off the material.

3. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.
4. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
  - a. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
  - b. Prepare joints and apply sealants to comply with requirements in Specification Section - SEALANTS.
5. .

C. Accessory Installation:

1. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
  - a. Install components required for a complete metal panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - a. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  - b. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
3. Pipe Flashing: Form flashing around pipe penetration and metal panels. Fasten and seal to metal panels as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Erection Tolerances:

1. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal panel installation, including accessories. Report results in writing.

C. Remove and replace applications of metal panels where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.



## 3.5 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
- B. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

## 3.6 METAL PANEL SCHEDULE

- A. Exterior Roof Sloped, and Exterior Wall:
  - 1. Style: Standing Seam, low slope.
  - 2. Manufacturer: CENTRIA.
  - 3. Type: SRS-3.
  - 4. Gage: 22.
  - 5. Size: 3" nominal high seams x 18" wide panels.
  - 6. Finish: "Fluoropolymer" 3-coat system.
  - 7. Remarks: Panels are to be flat with no dimples. Provide 1-1/4"wide "T" shaped caps.
- B. Exterior Wall:
  - 1. Style: Ribbed.
  - 2. Manufacturer: CENTRIA.
  - 3. Type: Inverted Box Rib, IBR5-36, exposed fastener.
  - 4. Gage: 22.
  - 5. Size: 1-1/2" deep x 36" coverage, 7.2" o.c. rib spacing.
  - 6. Finish: "Fluoropolymer" 3-coat system, one side only.
- C. Exterior Wall, Back of Parapet Panel:
  - 1. Style: Econolap 3/4"
  - 2. Manufacturer: CENTRIA.
  - 3. Type: G-90 Galvanized Steel.
  - 4. Gage: 20.
  - 5. Size: 34" width.
  - 6. Finish: Galvanized.

END OF SECTION

## SECTION 075113 - BUILT-UP ROOFING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, transportation, equipment, and services necessary to completely install all cold process bituminous roofing materials, accessories, and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - DIVISION 01 SPECIFICATION SECTIONS.
  - 02 41 19 SELECTIVE DEMOLITION
  - 07 21 00 INSULATION
  - 07 60 00 SHEET METAL
  - 09 29 00 GYPSUM BOARD
  - SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ANSI/SPRI American National Standards Institute, ES-1 Document
    - ARMA Asphalt Roofing Manufacturers Association.
    - ASCE American Society of Civil Engineers.
    - ASTM American Society for Testing and Materials
    - CRRC Cool Roof Rating Council.
    - NIST National Institute of Standards and Technology, BSS #55, Building Series #55: Preliminary Performance Criteria of Bituminous Membrane Roofing.
    - NRCA National Roofing Contractors Association.
    - SMACNA Sheet Metal and Air Conditioning Contractors National Association.
    - UL Underwriter's Laboratory (UL) test certification labels or equivalent testing agency with same follow-up testing and certified label program must be displayed on related roof assembly materials.

## 1.3 DEFINITIONS

- A. Roofing Terminology:
  - 1. Refer to ASTM D 1079 "Terminology Related to Roofing and Waterproofing" and the glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this section.

## 1.4 SYSTEM DESCRIPTION

- A. General

1. Performance Requirements:
  - a. Fire Rating:
    - 1) Equivalent to UL Class A.  
UL 790 "Standard for Standard Test Methods for Fire Tests of Roof Coverings" for application and roof slopes indicated.
  - b. Wind Uplift: The completed roof system requires test results showing resistance to 90 pounds per square foot wind uplift pressures.

Typical system components for all roofing types:

Flashings and Flashing Accessories.

Tall Parapet Flashing: Single-ply membrane (KEE) at parapets over 48 inches in height.

Reflective Surfacing Coating over Cap Sheet.

- B. The extent of cold process bituminous roofing system work is indicated by provisions of this section, and is defined to include roofing, insulation immediately under the roofing systems, elastomeric flashings, stripping, walkpads, and roofing accessories integrally related to roofing installation with all compatible with manufacturer's warranty requirements.

## 1.5 SUBMITTALS

### A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Coordination Drawings:
  - a. Submit installer's coordination drawings indicating the work of this section coordinates with that of related sections for proper interface of the completed work. Installer shall coordinate and obtain approvals of other related sections prior to submitting to the Architect.  
Submit one-way roof vent location plans to the Architect for approval that has been approved by the roofing manufacturer as to location in conjunction with all proposed roof penetrations.
2. Product Data.
  - a. Submit manufacturer's product data including performance requirements of all materials.  
Material Safety Data Sheets will not be reviewed, but if submitted will be turned over to the Owner in compliance with local rules and regulations.  
Indicate Energy Star compliance.
3. Shop Drawings.
  - a. The Roofing Contractor, in concert with the Material Manufacturer, is to submit detailed drawings of all flashing and roofing system details compatible with the manufacturer's requirements for the roofing system warranties, required herein for review and approval, prior to start of roof framing by the General Contractor.
    - 1) Insulation fastening patterns.  
Base, perimeter, and detail flashings, cants, and membrane terminations.  
Roof plan showing orientation of steel roof deck and roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
4. Samples:
  - a. 12 by 12 inch square of ply sheet and flashing backer sheet.  
12 by 12 inch square of mineral-granule-surfaced cap flashing sheet, of color specified.  
12 by 12 inch square of roof insulation.  
Six insulation fasteners of each type, length, and finish.
5. Quality Assurance/Control Submittals:
  - a. Qualification Data:
    - 1) Installer.

Manufacturer.

Manufacturer, Technical Representative.

Manufacturer's Testing Agency.

b. Certificates:

Installer: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

c. Manufacturer's Field Reports:

- 1) Submit three (3) copies of manufacturer's field reports for each roofing system type indicated (i.e. those appropriate for concrete decks, metal decks, or wood decks) indicating the final status of the installed roofing systems over various roof decking systems, and that they are in compliance with the manufacturers's warranty requirements.

6. Closeout Submittals in accordance with Specification Sections in Division One:

- a. Project Record Documents in accordance with Specification Section - PROJECT RECORD DOCUMENTS.

Warranty in accordance with Specification Section – WARRANTIES, and this specification section.

Manufacturer's maintenance instructions.

## 1.6 QUALITY ASSURANCE

### A. Qualifications:

#### 1. Material:

- a. The Roofing Contractor shall ensure that all products used in conjunction with the installation of the new roofing system(s) are totally free of asbestos. Products containing asbestos are prohibited on this project.

All adhesives and cements shall be compliant with current applicable VOC Requirements State and Local on the project.

The Roofing Contractor shall use products with personal protection when applicable.

The Roofing Contractor shall insure that all product users read container labels and MSDS information prior to use.

#### 2. Installer:

- a. Shall be experienced and certified in writing by the Manufacturer for license and to install manufacturer's products and systems in accordance with the manufacturer's warranty requirements.

The Roofing Contractor and installers shall be:

- 1) Experienced and certified in writing by the Manufacturer to install manufacturer's products and systems in accordance with the manufacturer's warranty requirements.

Acceptable to the Owner, Architect, and Manufacturer.

Provide a list of at least three (3) projects available for inspection employing specified system(s) within the last three years, within the same climate zone, and within seventy-five (75) miles distance of the project site.

Responsible for obtaining all data required from Manufacturer.

#### 3. Manufacturer:

- a. Provide, produce, label, and warrant all major and/or primary components of the specified roofing system, can exhibit ten million dollars (\$10,000,000) product liability, or a two million dollar (\$2,000,000.) product liability policy with a five million dollar (\$5,000,000.) umbrella per event insurance coverage and comply with all other requirements of the specification.

Be nationally recognized in roofing and waterproofing industry for at least ten (10) years.

Provide authorized, local, full-time employed Technical Field Representative to make periodic site visits, photograph the project, and provide written reports on work quality and job progress.

Provide a list of at least three (3) projects available for inspection employing the same system(s) within the last three (3) years, within the same climate zone, and within a seventy-five (75) mile distance of the project site.

Provide certified independent laboratory test results for all roofing materials using ASTM, FMG, or WH test criteria designated in PART 2 – PRODUCTS article of this specification indicating compliance with the design and performance criteria contained herein.

The presence and activity of the manufacturer's technical representative and/or Owner's representative shall in no way relieve the roofing contractor of their contractual liabilities and responsibilities.

**B. Regulatory Requirements:**

1. In accordance with Specification Section - Regulatory Requirements, and the following:
  - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.

**C. Meetings:**

1. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
  - a. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and other installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.

Review methods and procedures related to roofing installation, including manufacturer's written instructions.

Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

Review work restrictions and requirements of temporary facilities and controls.

Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

Review structural loading limitations of roof deck during and after roofing.

Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.

Review governing regulations and requirements for insurance and certificates if applicable.

Review temporary protection requirements for roofing system during and after installation.

Review roof observation and repair procedures after roofing installation.
2. Pre-installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with all other related work.

Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
3. Progress Meetings: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.

Identify any installation problems and acceptable corrective measures.

Identify any measures to maintain or regain project schedule of necessary.

4. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

### A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

Handle materials to avoid bending, tearing, or other damage during transportation and installation.

Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing.

- a. Do not operate or situate material handling equipment in locations that will hinder smooth flow of vehicular or pedestrian traffic.

### B. Acceptance at Site:

1. Coordinate delivery with Contractor.

Products delivered to the job-site must be in manufacturer's original, new, dry and unopened containers with labels indicating brand name, grade, ASTM number, FMG classification and UL Listings as required.

Deliver materials in sufficient quantity to allow continuity of work.

Damaged products will not be accepted.

### C. Storage and protection:

1. Products shall be stored above ground or roof on level platforms, six (6) inches above ground, allowing air circulation under stacked units.

- a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

Store roll goods on ends only and protect from moisture contamination of any kind.

Discard rolls and insulation which have flattened, creased, allowed to become damp/wet, or otherwise damaged.

Place and store materials on pallets.

Do not stack pallets.

Protect stored liquid material from direct sunlight

- 1) Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

2. Store materials marked "keep from freezing" in areas where temperatures will remain above 40 degrees Fahrenheit.

Neatly stack products on dunnage.

Remove breathable waterproof covering. Cover top and sides of all stored materials at interior and exterior storage areas with canvas tarpaulin or equivalent cover to allow the materials to "breathe".

- a. Secure cover.

Do not use polyethylene to cover materials.

3. Rooftop Storage: Disperse material to avoid concentrated loading, and to avoid permanent deflection of the deck. Any damage to the structure resulting from non-conformance to this requirement will be the sole responsibility of the roofing contractor.

Materials necessary for two day's work may be stockpiled on roof under the provisions outlined in paragraph 5 above.

No materials may be stored in opening or in contact with ground or roof/deck surface.

The Roofing Contractor shall assume full responsibility for the protection and safekeeping of roofing materials and products stored on the job-site premises.

## 1.8 PROJECT CONDITIONS

### A. Environmental requirements:

1. Do not work in rain, snow, or in presence of moisture, including dew or fog.

Do not work in temperatures at or below 40 deg. F.

Do not install materials marked "keep from freezing" in areas where temperatures will remain below 40 deg. F.

Remove any work exposed to freezing and replace with new.

### B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

The Roofing Contractor shall have SOLE responsibility for accuracy of all measurements, estimates or material quantities and sizes, and site conditions that will affect work.

## 1.9 WARRANTY

### A. Contractor's General warranty:

1. In accordance with specification section – WARRANTIES.

### B. Manufacturer's Warranty:

1. Upon Notice of Substantial Project Completion and manufacturer's acceptance of the completed roofing system, the Manufacturer shall complete, sign, and submit to the Owner the Warranty form at the end of this specification section, covering labor and materials without monetary limitations in which manufacturer agrees to repair or replace components of the roofing system that fail in materials or workmanship within the specified warranty period. Failure includes roof leaks.

a. Warranty Period: Twenty (20) years

1) From Notice of Substantial Completion.

b. This Warranty includes roofing membrane, base flashings, roofing membrane, accessories, coatings, adhesives, and other components of the roofing system.

### C. Installer's Warranty:

1. Upon Notice of Substantial Project Completion, the Installer shall complete, sign, and submit to the Owner the Warranty form at the end of this specification section covering the Work of this section including all components of the roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, coatings, adhesives, and walkway products.

a. Warranty Period: Three (3) years

1) From the Notice of Substantial Completion.

- b. The continuity of the warranty will not be dependent upon Owner's requirements to contact the manufacturer at certain intervals during the warranty period and completing additional work to the roof at the direction of the manufacturer, under the threat of cutting short the full specified warranty duration.

## 1.10 MAINTENANCE

- A. Inspection Service:
  - 1. Roofing System Manufacturer to inspect the roof system in years two, five, ten and fifteen of the warranted roof system. Report findings in writing to the Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. Any substitution of named materials, even if accepted by the approved manufacturers listed, must go through substitution request procedures and meet the minimum requirements listed herein. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Cover Board and Cant Strips as manufactured by:
    - a. BLUE-RIDGE FIBERBOARD.  
GEORGIA-PACIFIC CORPORATION.  
TEMPLE-INLAND INC.
  - 2. Cricket or Rigid Board as manufactured by:
    - a. RMAX.
  - 3. Cold-Process Built-up Modified Roofing and compatible accessories as manufactured by:  
Specified Built Up Roofing System product manufacturer:  
TREMCO, INC.  
Acceptable alternative manufacturers:
    - a) THE GARLAND COMPANY.

### 2.2 MATERIALS

- A. Slip Sheet Underlayment: ("Red Rosin Paper") Used at Wood Decks unless otherwise indicated.  
Multi-Purpose Building Paper: a high quality, single ply, sheathing paper, that is widely used in built-up roofing systems as a "first layer" protective barrier. Fibers set in alum to resist bleeding. Thickness: 9.0 to 11.5 mils.
- B. Insulation Materials:
  - 1. Wood Components including Nailers, Cants, etc:
    - a. Comply with Specification Section – ROUGH CARPENTRY.
  - 2. Cover Board:



- a. Fiberboard: Fibrous-felted wood fiber or other cellulosic-fiber, and water-resistant binders, asphalt impregnated on two sides, in accordance with ASTM C 208 "Specification for Cellulosic Fiber Insulating Board", Type II, Grade 1.
  - 1) Provide tapered edge strips, of the same material.Size: 4' x 8' x 1/2 inch minimum thickness (or as required for a Class A Fire Resistant Rated Roof System).
3. Cricket and Rigid Board:
  - a. Isocyanurate Insulation Board: FS HH-1-1972/2(1), Type II, Class 1, isocyanurate with fiber/organic mat facer on both sides, conditioned "R" value of 5.70 per inch. Flame Spread and Smoke Developed in accordance with ASTM E 84 "Test method for Surface Burning Characteristics of Building Materials":
    - 1) Flame Spread Index: 25 - 60.Smoke Density Developed Index: 75 – 160 range.
  - b. Rigid Board Size: 4' x 8' x thickness as indicated on the drawings (minimum thickness as required for a Class A Fire Resistant Rated Roof System), and as indicated for roof slope.
  - c. Cricket Board Size: 2' x 4' dimension minimum, tapered thicknesses, slope as indicated
4. Cant Strip:
  - a. Fiberboard, in accordance with ASTM C 208 "Specification for Cellulosic Fiber Insulating Board".
    - 1) Minimum thickness: Three (3) inches nominal, face 4 inches nominal.Length: Forty-eight (48) inches.
5. Insulation adhesive:
  - a. Low rise foam insulation adhesive.  
Specified product manufacturer:  
TREMCO, INC. , "Tremco Low Rise Foam Insulation Adhesive".  
Acceptable alternative manufacturers:
    - a) THE GARLAND COMPANY, "Insul-Lock HR".
- C. Mechanical Fasteners:
  1. Provide industry-standard, non-corrosive types of mechanical fasteners meeting the corrosion resistant provisions in FMG 4470 (i.e.: screws and plates, termination bars, drawbands) for cold process built-up roofing system work, tested by manufacturer for required pull-out strength where applicable and compatible with substrate type, roofing products used and warranties required.
    - a. Size of fasteners and plates shall be as recommended by roofing manufacturer in accordance with manufacturer's warranty requirements, and sufficient to comply with wind uplift requirements.
- D. Roofing Materials:
  1. Roof Cement:
    - a. Fibrated asphalt mastic meeting or exceeding ASTM D 4586 "Specification for Asphalt Roof Cement, Asbestos-Free".
  2. Primer for all sheet metal and concrete surfaces:
    - a. Quick drying, asphaltic primer meeting or exceeding ASTM D 41 "Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing" and complying with CARB requirements.
  3. Interply Adhesive:

- a. Roofing system manufacturer's standard asphalt-based, one-part asbestos-free, cold-applied adhesive specially formulated for compatibility and use with built-up roofing membranes and flashings, with low-VOC formulation acceptable to authorities having jurisdiction:  
Specified product manufacturer:  
TREMCO, INC., "POWERply Standard Cold Adhesive LV".  
Acceptable alternative manufacturers:  
THE GARLAND COMPANY, "Weather King Plus WC Adhesive".
4. Interply Felt Sheet:
  - a. Meets the requirements of ASTM D 4601 "Specification for Asphalt-Coated Glass Fiber Interply Sheet Used in Roofing", Type II.  
Specified product manufacturer:  
TREMCO, INC., "BURmastic Glass Ply".  
Acceptable alternative manufacturers:  
THE GARLAND COMPANY, "HPR Premium Glasbase Sheet".
5. Flashing Adhesive:
  - a. Roofing system manufacturer's asphalt-based, one-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with built-up roofing base flashings.
6. Mastic Sealant:
  - a. Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.
7. Cap Sheet (Surface and Flashing):
  - a. Per ASTM D 6163 "Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements", Grade G, Type III, glass-fiber-reinforced, SBS Modified Asphalt Sheet, "White" Granular Surfaced.  
Specified product manufacturer:  
TREMCO, INC., "Powerply Plus HT FR Mineral".  
Acceptable alternative manufacturers:  
THE GARLAND COMPANY, "Versiply Mineral".
8. Reflective Surfacing Coating: Roof Coating / Top Coat, acrylic Latex coating, highly reflective, elastomeric, and compatible with Modified Bitumen surfaces, meeting CRRC "Cool Roof" requirements  
Specified product manufacturer:  
TREMCO, INC., "Polarcote FR White Coating".  
Acceptable alternative manufacturers:  
THE GARLAND COMPANY, "Pyramic White Coating".
9. Tall Parapet Flashing:  
Ketone Ethylene Ester (KEE) Content: Not less than 50 percent by weight of the polymer content of the sheet when tested in accordance with ASTM D8154.  
Thickness: 45 mil.  
Color: White.  
Width: as necessary to eliminate horizontal seams.  
Specified product manufacturer:  
TREMCO, INC., "TremPly KEE".  
Acceptable alternative manufacturers:
  - a) THE GARLAND COMPANY, "KEE-Stone".
10. Caulking:
  - a. Single component, non-sag, epoxidized polyurethane sealant, per Federal Specification TT-S-00230C.
11. Walkpads:

- a. As recommended by manufacturer in accordance with manufacturer's warranty requirements.

Size as indicated on the drawings, in patterns and routes sufficient to protect adjacent roof areas from damage during anticipated maintenance of roof mounted equipment.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

##### A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

Prior to installation of roofing, the Roofing Contractor shall inspect the new deck conditions and verify that the new roof system may be installed in strict accordance with original design, the manufacturer's current recommendations, and all other pertinent codes and regulations.

- a. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

Check projections, curbs, and deck for foreign material and moisture that would prevent quality and execution of the new roofing system.

2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.

Execution of work under this specification section shall constitute acceptance of existing conditions.

##### B. General quality of work:

1. Substrate shall be free of foreign particles prior to laying roof membrane.

Phased application:

- a. Not permitted.

All plies shall be completed each day.

#### 3.2 PREPARATION

##### A. Coordination:

1. Coordinate work under this specification section with work specified under other specification sections to ensure proper and adequate interface of work.

##### B. Protection:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

Roofing Contractor shall be responsible for protection of property during course of work.

- a. Lawns, shrubbery, paved areas, and building shall be protected from damage. Repair damage at no extra cost to Owner.

2. Provide at site prior to commencing removal of debris, a dumpster or dump truck to be located adjacent to building where directed by General Contractor.
- Roofing, flashing, membrane repairs, and insulation shall be installed and sealed in a watertight manner on same day of installation or before arrival of inclement weather.
- a. Insulation shall not be left exposed at the end of the work day.
3. At start of each work day drains within daily work area shall be plugged.
    - a. Plugs to be removed at end of each work day.
  4. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day.
- Substrate-Joint Penetrations:
- a. Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
5. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement.
- At end of each working day, completed segment shall be sealed with water stops along edges to prevent water infiltration. Refer to INSTALLATION for specific instruction.
- Provide clean plywood walkways and take other precautions required to prevent tracking of debris into new membrane area where debris pieces can be trapped within new roofing membrane.
- a. Contractor shall instruct and police his/her workers to ensure that debris is not tracked into or allowed to be wind driven into the new membrane.
- Discovery of entrapped debris or other foreign matter within new membrane is sufficient cause for rejection of the membrane.

### 3.3 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    - a. In accordance with applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing".
  2. In accordance with approved submittals.
- In accordance with Regulatory Requirements.
- Start installation of built-up roofing membrane in presence of roofing system manufacturer's technical personnel.
- Cooperate with testing and inspecting agencies engaged or required to perform services for installing built-up roofing system.
- Cold Process Asphalt Heating:
- a. An in-line heat exchange unit may be used to facilitate application.  
Do not exceed maximum adhesive temperature of 100 deg. F.  
Heat exchange unit: Use heat transfer oil approved by heating equipment manufacturer.  
Follow operation procedures recommended by heating equipment manufacturer.
3. Roofing materials shall not be installed during inclement weather. Roofing materials shall not be applied when moisture in any form, such as dew, can be seen or felt on the surface to which those materials are to be applied.
- Staging of the roof membrane application or temporary membrane is not acceptable.
- Membrane shall be installed in final form, with the exception of the cap sheet, on a daily basis.
- a. If phased roofing occurs, following prior approval of the Architect, as a result of emergency conditions, install additional plies over phased areas so that the total specified number of plies are installed.

**B. Insulation Installation:**

1. General: All insulation will extend over horizontal surfaces, including parapet braces, until the insulation boards meet the vertical parapet wall surfaces.
  - a. Provide pre-formed saddles, crickets, tapered edge strips and other insulation shapes to slope to drain. Fabricate to slopes indicated.  
Flush all insulation board surfaces that meet adjacent surfaces to be free from any uneven or gapped joints, sharp edges or other irregularities.  
Install with long joints of insulation in a continuous straight line with end joints staggered between rows abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
    - 1) Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
  - b. Trim surface of insulation where necessary, at roof drains so completed surface is flush and does not restrict water flow.  
Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.  
Install and secure 45-degree cant strips at junctures of built-up roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.

**C. Flashing:**

1. General:
  - a. All other flashings not specifically detailed herein will be applied in accordance with manufacturer's written recommendations and approved by the Architect.  
All sheet metal that will come in contact with bituminous materials shall be primed with the specified asphaltic primer and allowed to dry before applying bitumen.

**D. Roofing System:**

1. Install two (2) plies of specified interply roofing felts over the cover board and the roof deck system, set into solid spray applications of cold-process asphalt in the following manner:
  - a. Starting at the low point of the roof, apply one 18 inch starter strip, and then over starter strip, apply a full 36 inch wide specified roofing felt. Following plies are to be applied full width, overlapping the preceding felt by 18 inches in such a manner that there be at least two (2) plies of interply felt at any point.  
Align sheets without stretching.  
Shingle in direction to shed water.  
Extend interply roofing felt sheets over and terminate beyond cants.  
Cut 12 to 18 foot lengths of specified felt, allow to relax thirty (30) minutes at 55 deg. F+ or sixty (60) minutes at 55 deg. F-. Flop shingle fashion into a full width application of cold-process asphalt applied at minimum nominal rate of 2.5 to 3.0 gallons per 100 square feet. The specified felt must be firmly and uniformly set into the asphalt with all edges well sealed.  
Lightly broom and/or roll each ply of specified felt into place, full width, immediately after installation. Felts shall lay flat and be fully bonded in such a manner that in no area shall touch felt. Use only a squeegee or conduit type broom.  
Apply uniform and continuous pressure to exposed edge and end laps to ensure complete adhesion.  
Lap ply ends 6 inches. Stagger end laps 3 feet minimum.  
Header laps in roof field shall be at least 2 feet.  
Overlap previous day's work 18 inches.  
Cut out and patch all fishmouths and side laps which are not completely sealed. Replace all sheets which are not fully and continuously bonded.

- Roof surface will be rolled after each work day to smooth fishmouths.
2. Install lapped cap sheet starting at the low point of roofing system.
    - a. Offset laps from laps of preceding interplay sheets and align cap sheet without stretching.  
Lap in direction to shed water.  
Extend cap sheet over and terminate beyond cants.  
Embed in a solid application of cold-process asphalt applied at a minimum nominal rate of 3.0 gallons per 100 square feet. The cap sheet must be firmly and uniformly set into the asphalt with all edges well sealed.  
Lightly broom and/or roll cap sheet into place, full width, immediately after installation.  
Use only a squeegee or conduit type broom.  
Replace all sheets which are not fully and continuously bonded.  
Roof surface will be rolled after each work day to smooth fishmouths.
  3. Valleys and waterways shall receive an additional ply of fiberglass felt which shall be at least 36 inches wide. This ply shall be laid on top of the insulation prior to the application of the other plies and shall extend at least 18 inches up the inclines, out of the valleys.
- Foot and wheeled traffic shall be kept off the newly installed membrane until asphalt has sufficiently cured to prevent displacement voids.
- All membrane deficiencies such as voids, bridging, fishmouths, cuts, tears, etc., shall be repaired in an acceptable manner. Incorporate into such repairs as many plies as are affected by the deficiency.
- Air void pockets, as determined by test samples, shall not exceed eight percent (8) per interply mopping for individual sample and average of all samples shall be not less than five percent (5) per interply adhesive. If corrective action is required, cut the roofing felts down to the void and cover with three plies of fiberglass felt set into cold-process asphalt applied at a nominal rate of 3 gallons per 100 square feet.

E. Wall Flashing:

1. Roofing contractor shall install base flashing at the base of all vertical wall, sloping conditions, roof edges, penetrations, and curb surfaces in the following manner:
  - a. All flashing must be temporarily sealed at the end of each working day.  
Refer to manufacturers recommended installation procedures and the system performance requirement for proper installation of perimeter flashings.  
Prime substrates with asphalt primer if required by roofing system manufacturer.  
All Wall Flashings will receive a backer sheet utilizing the interplay sheet
    - 1) Mechanically fasten to parapets or walls.  
Adhere over roofing membrane at cants in flashing adhesive.
  - b. All Wall Flashings will receive a Cap flashing sheet adhered using flashing adhesive applied at a rate required by the roofing system manufacturer.  
When parapet walls exceed three (3) feet in height install all backer and cap flashing sheets in Type IV asphalt. Consult the manufacturer to eliminate potential hazards of using hot asphalt over cold process adhesives.  
Extend base flashing up wall or parapets a minimum of eight (8) inches, or as indicated, above roofing membrane and extend a minimum of six (6) inches on to the field of roofing membrane.
    - 1) Wall Flashing shall extend from the top of the parapet and down the inside face of the wall. Embed the flashing sheet in a continuous application of flashing adhesive.

Secure the top edge of the wall flashing using a galvanized metal termination bar. Fasten the termination bar to concrete walls using concrete screws turned into pre-drilled holes at eight (8) inches on center. Fasten the termination bar to plywood walls using screws at eight (8) inches on center.

- c. Mechanically fasten top of Wall Flashing securely at terminations and perimeter of roofing.

**Tall Parapet Wall Flashing Installation:**

Roofing Contractor shall install base flashing at the base of all existing vertical wall and curb surfaces in the following manner:

All flashing must be temporarily sealed at the end of each working day..

Wall Flashing shall extend from the outside edge of the parapet wall cap, over the top, and down the inside face of the wall. Embed the KEE flashing sheet in a continuous application of flashing adhesive per the manufacturer's current written recommendations. The flashing membrane shall be of sufficient length to extend from the outside edge of the parapet cap, over the top of the vertical flashing surface (and under the parapet sheet metal cap) to a minimum of 6 inches past the toe of the cant strip onto the roof.

Wipe seams of the base flashing membrane with a manufacturer recommended solvent. Lap seams a minimum 4 inches and completely adhere with a heat welding application. Cross roll laps with 2 inch steel roller.

Top edge of flashing membrane shall be stuck into caulking tape. Bottom edge of flashing membrane shall be three-coursed. Make sure flashing is installed without any looseness. Remove and replace any loose flashing.

Secure the top edge of the base flashing over the area where the caulking tape is installed behind the KEE base flashing membrane, using a galvanized metal termination bar. Fasten the termination bar to concrete walls using concrete screws turned into pre-drilled holes at 8 inches on center. Fasten the termination bar to plywood walls using screws at 8 inches on center.

The flashing sheet shall extend to the outside edge of all raised edge nailers.

**F. Roof Drain Flashing:**

- 1. Drain rings shall be removed prior to built-up roofing application.

A minimum 3 foot square, primed lead flashing sheet shall be set into a solid coating of asphaltic mastic over the installed roofing plies.

- a. Install a two (2) ply stripping using specified base sheet.

First ply shall be embedded in a asphaltic mastic and shall cover the lead completely and extend onto the field of the roof 6" in all directions.

Second ply shall be embedded in cold process adhesive, fully covering the first stripping ply and extending past the first ply a minimum of 6" in all directions.

All plies, including the lead flashing and field plies must extend into the drain and under the clamping ring.

- 2. The drain ring shall be set into asphaltic mastic and immediately tightened. A guard screen shall be installed over all drains.

After complete installation of the roofing system, Roofing Contractor shall inspect and test all roof drains to assure that no clogging of the drainage system is present. The roof drain leader should be in such condition that full diameter of the drain leader is clear.

**G. Flanged Metal Components:**

- 1. Prime all metal that is to come into contact with asphaltic compounds with specified primer.

All flanges shall be set into asphaltic mastic over the finished roofing plies.

- a. Galvanized metal flanges will sit in a bed of asphaltic mastic and be fastened to the underlying wood nailers at three (3) inches on center, staggered.  
Lead flashing flanges will sit in a bed of asphaltic mastic and tamped down securely.
2. All flanges, including pipe flashing, edge flashing, flanged vents, flanged units, pitch pans, etc., will be flashed on the roof with two plies of stripping ply sheet. Install a two (2) ply stripping using specified sheets. First ply shall be embedded in a asphaltic mastic and shall cover the lead completely and extend onto the field of the roof 6" in all directions. Second ply shall be embedded in cold process adhesive, fully covering the first stripping ply and extending past the first ply a minimum of 6" in all directions.

H. Edge Metal:

1. Set edge metal into layer of asphaltic mastic over finished field plies.  
Install metal cleats. Cleats shall be at least one gage heavier than the metal edge.  
Metal sections shall be a maximum of ten (10) feet in length.
  - a. Leave a minimum of 1/2" space between metal sections.  
Install a minimum of 4" wide lap over and nail in place through 1/2" gap in metal sections.  
Nail metal edge 3" o.c. staggered.

I. Walkpad Installation:

1. Install walkpad panels in a path 3 feet wide around all HVAC mechanical units requiring regular maintenance (coordinate with mechanical contractor for items requiring maintenance). Space between pads no greater than 6 inches, and no less than 4 inches  
Adhere to roofing in a spot application of asphalt mastic.

### 3.4 APPLICATION

A. Apply Reflective Surfacing Coating:

1. Apply to roofing membrane and base flashings not less than 40 days following completion of membranes.  
Apply by manufacturer's written instructions.  
Remove all dirt, dust, and other loose debris from the roof. Area to be coated must be a clean, sound, and dry surface.  
Prime surfaces as required.  
Apply by spray, roller, or other suitable application method.  
Materials shall be installed in a two-coat application. The second coat shall be applied perpendicular to the first coat.  
Spray and backroll first coat applying 1.5 gallons per 100 square feet.  
Spray second coat applying 1.5 gallons per 100 square feet. For a total of 3 gallons of coating per 100 square feet.

### 3.5 REPAIR / RESTORATION

A. Repair of deficiencies:

1. Installations of details noted as deficient during Final inspection must be repaired and corrected by the Roofing Contractor and made ready for re-inspection, within five (5) working days of notification.



## 3.6 FIELD QUALITY CONTROL

- A. Manufacturer's representative:
  - 1. Local manufacturer's field representative shall provide inspections, reports, and job site visits during the installation of roof system. Minimum of 3 days per week with reports sent via e-mail to Owner and Architect. Pictures must be included.
- B. Final Roof Inspection:
  - 1. Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
    - a. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.7 CLEANING

- A. Clean in accordance with Specification Section – PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces at the end of each day, minimum.  
Finish shall be clean and ready for the application of any additional finishes.

## 3.8 PROTECTION

- A. Protection from weather:
  - 1. Protect newly installed work from freezing for 24 hours after erection, installation or application.
- B. Protection from traffic:
  - 1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

## 3.9 SCHEDULES / FORMS:

- A. WARRANTY:

WHEREAS \_\_\_\_\_ of \_\_\_\_\_, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

- 1. Owner: \_\_\_\_\_  
Address: \_\_\_\_\_  
Building Name/Type: \_\_\_\_\_  
Address: \_\_\_\_\_  
Area of Work: \_\_\_\_\_  
Acceptance Date: \_\_\_\_\_  
Warranty Period: \_\_\_\_\_  
Expiration Date: \_\_\_\_\_

- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
  - a. lightning.peak gust wind speed exceeding 74 mph;  
fire.  
failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition.  
faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;  
vapor condensation on bottom of roofing; and  
activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

C. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_ day of \_\_\_\_\_, 2021.

1. Authorized Signature: \_\_\_\_\_

Name: \_\_\_\_\_

END OF SECTION

## SECTION 07 60 00– SHEET METAL

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Sheet Metal materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 06 41 23 MODULAR CASEWORK
  - 5. 07 21 00 INSULATION
  - 6. 07 40 00 METAL PANELS
  - 7. 07 51 13 BUILT-UP ROOFING
  - 8. 07 72 00 ROOF ACCESSORIES
  - 9. 07 92 00 SEALANTS
  - 10. 08 11 00 METAL DOORS AND FRAMES
  - 11. 09 24 00 CEMENT PLASTER
  - 12. 09 91 00 PAINTING
  - 13. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 14. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. DOD Department of Defense
  - 2. LIA Lead Industries Association.
  - 3. NRCA National Roofing Contractors Association
  - 4. SMACNA Sheet Metal and Air Conditioning Contractor's National Association, 6th Edition, Architectural Sheet Metal Manual.
  - 5. SSPC The Society of Protective Coatings

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Shop Drawings.
    - a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
  - 2. Closeout Submittals in accordance with Specification Sections in Division One:
    - a. Warranty in accordance with Specification Section - WARRANTIES.

## 1.4 QUALITY ASSURANCE

- A. Qualifications:

1. Material Qualifications:
  - a. Work shall be in accordance with Standards and details set forth in latest edition of the SMACNA Manual and Specifications unless indicated otherwise.
  - b. The roofing manufacturer and installer selected for this project will select the roof flashing material and detailing for all roof penetrations compatible with the roofing system used and the warranties required. The schedule for roofing penetrations at the end of this section and the details contained within the drawings are minimum standards required for this project.
2. Installer Qualifications:
  - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- B. Regulatory Requirements: In accordance with Specification Section - REGULATORY REQUIREMENTS.

## 1.5 PROJECT CONDITIONS

- A. Existing Conditions:
  1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

## 1.6 WARRANTY

- A. Contractor's General Warranty: In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty: In accordance with Specification Section - WARRANTIES.
  1. Warranty Period Five (5) Years.
- C. Installer's Warranty:
  1. Workmanship and Materials Warranty:
    - a. Warranty Period Five (5) years.
    - b. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.
    - c. The subcontractor shall warranty to maintain the roof flashing in a watertight condition for the period of years specified from the date of acceptance and shall be responsible for the repair of any failure that is the result of defects in materials and workmanship.
    - d. The subcontractor shall obtain from the Roofing Installer and the General Contractor a co-endorsement of the Warranty.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified product manufacturer:
    - a. Ice and Water Shield:
      - 1) GRACE CONSTRUCTION PRODUCTS
        - a) ICE and WATER SHIELD HT.
      - 2) Acceptable alternative manufacturers:
        - a) CARLISLE COATINGS & WATERPROOFING - CCW WIP 400.
    - b. Penetration Flashing:
      - 1) GRACE CONSTRUCTION PRODUCTS "VYCOR V40."
      - 2) Acceptable Alternative Manufacturer:
        - a) FORT-I-FIBER "Fort-I-Flash 40."
        - b) TYVEK "FlexWrap" and "Straight Flash."
    - c. Reglets:
      - 1) FRY REGLET CORPORATION.
    - d. Primer Paint:
      - 1) DEVOE COATINGS PAINT.
    - e. Galvanized Repair Paint:
      - 1) RECTORSEAL.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Sheet Metals:
1. Steel Sheet:
    - a. Zinc-Coated, Commercial quality with 0.20 percent copper, ASTM A 653 "Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process," G-90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359 inch thick (20 gauge) minimum, except as otherwise indicated.
  2. Lead Sheet:
    - a. ASTM B 749 "Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products," Type L51121, copper-bearing sheet lead, minimum 4 lb/sq. ft. (0.0625 inch thick) minimum for burning (welding) unless otherwise indicated.
  3. Aluminum Sheet:
    - a. Provide sheet aluminum in accordance with ASTM B 209 "Specification for Aluminum and Aluminum-Alloy Sheet and Plate," alloy 3003, temper H14, AA-C22A41 clear anodized finish.
      - 1) Gauge: 0.063 inches.

- 2) Prepare anodized finish for application of primer and finish coats as indicated on the drawings.

## 2.3 MANUFACTURED UNITS

### A. Reglets:

1. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Plaster Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
4. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
  - a. Material: Galvanized steel, thickness matching material being installed, unless otherwise noted.

## 2.4 ACCESSORIES

### A. Solder:

1. For galvanized steel: ASTM B 32 "Specification for Solder Metal," Grade Sn50, used with rosin flux.
2. For stainless steel: ASTM B 32 "Specification for Solder Metal," Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

### B. Fasteners:

1. Same material as sheet metal or other non-corrosive metal as recommended by sheet metal manufacturer, unless otherwise indicated on the drawings.
  - a. Match finish of exposed heads with material being fastened.

### C. Electrolytic Insulation:

1. Asphalt Mastic:
  - a. SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.
2. Other electrolytic insulation materials:
  - a. Asphalt impregnated felt, neoprene or EPDM rubber.

### D. Sealants shall be in accordance with Specification Section - SEALANTS.

1. Mastic Sealant:
  - a. Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
2. Elastomeric Sealant:
  - a. Generic type recommended by sheet metal manufacturer and fabricator of components being sealed.
3. Epoxy seam sealer:

- a. 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.
- E. Adhesives:
  - 1. Type recommended by sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of sheet metal.
- F. Metal Accessories:
  - 1. Provide sheet metal clips, straps, anchoring devices, screens, mesh, and similar accessory units as required for installation of work, matching or compatible with material being installed; noncorrosive; size and thickness matching material being installed.
- G. Roofing Cement:
  - 1. ASTM D 4586 "Specification for Asphalt Roofing Cement, Asbestos Free," Type I.
    - a. Verify with roofing material utilized for this project as being compatible with materials and roofing manufacturer's warranty requirements.
- H. Gutter Sealing System (when applicable):
  - 1. Primer:
    - a. Suitable for metal gutter metal type and compatible with Coatings and Fabrics.
  - 2. Base, Intermediate and Finish Layer Coating:
  - 3. Base Layer Fabric: Polyester Fabric compatible with primer and coatings.
- I. Penetration Flashing:
  - 1. Self-Adhered and self-healing weather barrier strips, in accordance with FS UU-B-790a, Grade A.
    - a. 40 mil. minimum thickness, in 9 inch and 12 inch widths as is appropriate for the barrier application.

## 2.5 FABRICATION

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
  - 1. Comply with details shown to fabricate sheet metal that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 2. Form exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
  - 3. Seams:
    - a. Fabricate nonmoving seams in sheet metal with "Drive Cleat" or "Lock" seams.
  - 4. Expansion Provisions:
    - a. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches of corner or intersection.
    - b. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
    - c. Gutter Expansion control and design, unless otherwise indicated on the drawings:
      - 1) Ends of a gutter shall occur no more than fifty (50) feet apart with at least one downspout in between, and gapped in accordance with Chapter 1, Table 1-7.



- 2) Adjacent ends shall be telescoped or enclosed with covers in a manner to accommodate expansion as indicated in Chapter 1, Fig. 1-5 to 1-7 and 1-10.
5. Sealed Joints:
  - a. Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
6. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
7. Conceal fasteners and expansion provisions where possible.
  - a. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
8. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
  - a. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

## 2.6 FINISHES

### A. Shop Finishing:

1. All exterior galvanized sheet metal, unless specified otherwise, shall have all surfaces, except surfaces receiving roofing felt, properly cleaned and prepared and then painted with one coat Galvanized Metal Primer prior to installation.
  - a. Galvanized Metal Primer: 4020PF "DEVGUARD," or approved equivalent.
  - b. Galvanized repair paint: High-Zinc-Dust-Content, in accordance with SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight paint for re-galvanizing welds and repair painting galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

#### A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

#### B. Protection:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

#### C. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
3. Prime substrates as required by manufacturer's written instructions and recommendations.

### 3.3 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Structurally reinforce and anchor work as required.
6. Work shall be weather and water tight as required.
7. Where dissimilar metals come into surface contact, cover surface in contact with electrolytic insulation.
8. Immediately following installation, and prior to roofing application, the metal will be primed with a quick drying primer compatible with roofing system installed and in compliance with roofing manufacturer's warranty requirements.

#### B. Layout:

1. Lines shall be straight and true.
2. Field mitered joints shall be neat, true to line, and water tight.
3. Fastening: In accordance with approved shop drawings.
4. Sealants: Seal all joints with sealant.

#### C. Assistance:

1. Installation shall be in direct consultation and review of roofing system manufacturer where applicable.

#### D. Penetration Flashing:

1. Apply Penetration Flashing in conjunction with Water Barriers, Metal Accessories and all other related work.
2. Install Penetration Flashing at all openings and penetrations at all exterior walls and at interior walls considered to be "Semi-Wet" and "Wet" exposures (i.e., Toilets, Showers, Lockers, Kitchens, etc.).
3. Install Penetration Flashings with Water Barriers, Metal Accessories and all other related work in "shingle" or "weatherboard" fashion.
4. Penetration Flashings shall be installed as required in CBC Sections 1404.4 in 9" widths and continuous to 9" past all intersections around all openings, penetrations and termination of Sheet Metal Systems.
  - a. Should any penetration warrant a greater width of wall flashing, provide 12" wide flashing as required.
  - b. When an object extends through the Sheet Metal System, return the edge of the Penetration Flashing 1" and apply to the sides of the penetrating item.
5. Objects such as electrical back-boxes, electrical speaker enclosures, penetrations created by structural members, and the like.

### 3.4 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces immediately.
  - 2. Finish shall be clean and ready for the application of any additional finishes.

### 3.5 SCHEDULES

- A. Architectural Sheet Metal Items: Items visible from the interior occupied spaces and from all exterior viewing positions. Fabrication of all Architectural Items shall provide a fully finished appearance on all visible surfaces. Fabrication shall be soldered or welded joints and ground smooth. Solid flat head riveted joints may be used if necessary, but limited in use and must be indicated on the shop drawings by the fabricator, and accepted by the Architect. The use of sheet metal screws, pop rivets, or bolts are not be permitted. All joints between section shall be uniformly gapped with a maximum of 1/16" and splice backing shall be centered on the joint.
- B. Utility Sheet Metal Items: Items not visible from the interior occupied spaces nor from exterior viewing positions. Fabrication of all Utility Items shall be in accordance with SMACNA Standards and shop practices.
- C. Sheet Metal Schedules are not considered as a complete list. Refer to Drawings for locations of all conditions requiring sheet metal items.
- D. Multiple types of material are specified for various items in the Schedules. Verify with roofing manufacturer as to which material shall be used to be compatible to the roofing material provided and to satisfy roofing warranty requirements.
- E. Materials gauges specified for Items in the Schedules are minimum and shall be provided unless otherwise noted on the Drawings.
- F. Schedule's Remarks / SMACNA No., 6th Edition, and are references of the standards for fabrication. Refer to Drawings for configurations and other fabrication requirements of sheet metal items.

## G. Architectural Sheet Metal Items

<b>ARCHITECTURAL SHEET METAL ITEMS</b>					
<b>ITEM</b>	<b>LOCATIO N</b>	<b>MAT.</b>	<b>GA.</b>	<b>FINISH</b>	<b>REMARKS / SMACNA NO., 6<sup>th</sup> Edition</b>
Parapet Cap	Parapet Walls	Steel	20	Shop	Chapter 3, similar to Fig. 3-4A or Fig. 3-4G with E-1 and E-4 edge styles, as indicated on drawings. Provide J9 "Drive Cleat" joints, typical.
Cap Coping	Parapet Walls	Steel	20	Shop	Chapter 3, similar to Fig. 3-4G with E-4 edge style, as indicated on drawings. Provide J9 "Drive Cleat" joints, typical.
Drip Flashing	Various Conditions	Steel	22	Shop	Chapter 4, minimum 4" under finish and minimum 4" cover. Provide J2 "Butt & Backup Plate" joints with 1/16" gap. Fabricate Transition pieces and End Caps.
Counter Flashing	Various Conditions	Steel	22	Shop	Chapter 4, minimum 4" under finish and minimum 4" cover with 3/4" hemmed drip. Provide J2 "Butt & Backup Plate" joints with 1/16" gap. Fabricate Transition pieces and End Caps.
Opening Heads, Jambs & Sill Flashing	Metal Frames	Steel	22	Shop	Weld and Grind smooth all joints
Opening Heads, Jambs & Sill Flashing	Storefront	Alum	0.0253	Match Storefront Finish.	Seal all joints.
Wall Penetration Flashing	Exterior Wall	Steel	22	Shop	Similar to Chapter 6, Figures 6-36, 37, 38 & 39.
Gutters	Exterior	Steel	18	Shop	Chapter 1, Fig. 1-1. Provide expansion joints similar to Fig. 1-7. Solder overflow and downspout outlets.
Fascia Panels	Exterior	Steel	18	Shop	Weld and grind smooth all joints.
Color Band Panels	Exterior	Steel	18	Shop	Weld and grind smooth all joints.

## H. Utility Sheet Metal Items

UTILITY SHEET METAL ITEMS					
ITEM	LOCATION	MAT.	GA.	FINISH	REMARKS / SMACNA NO., 6 <sup>th</sup> Edition
Clips & Cleats	Various Conditions	Steel	22	Shop	
Parapet Boot Flashing	Parapet Cap & Cap Coping	Steel	18	Shop	Solder all joints. Minimum 4" under finish and min. 4" cover.
Counter Flashing	Various Conditions	Steel	22	Shop	Minimum 4" under finish and min. 4" cover with ¾" hemmed drip. Provide J2 "Butt & Backup Plate" joints with 1/16" gap. Fabricate Transition pieces and End Caps.
Reglet & Counter Flashing	Plaster Parapets	Steel	24	Shop	FRY Spring Lock Type "ST" with "Spring-Loc" Flashing. Preformed transition pieces and end caps.
Structural Support Flashing	Roof Penetration	Steel	18	Shop	Chapter 4, Similar to Figures 16A or B or C if welded or soldered, and grind smooth.
Vent Pipe Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, Fig. 4-15B.
Pipe or Conduit Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, similar to Figure 4-15C.
Multiple Pipe or Conduit Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop Or Shop	Chapter 4, similar to Figure 4-15A or 4-15B.
Insulated Pipe Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, Similar to Fig. 4-15C. Refer to Plumbing.
Mechanical Flue Pipe Flashing	Roof Penetration	Lead or Steel	4#/sf or 22	Shop	Chapter 4, Similar to Fig. 4-15C. Refer to Plumbing.
Manufactured Curb Flashing	Roof Penetration	Steel.	22	Shop	Provide formed metal corners lapped 6" with sheet metal screws with neoprene washers at 18" o.c.
Hatch Flashing	Roof Penetration	Steel.	22	Shop	Provide formed metal corners lapped 6" with sheet metal screws with neoprene washers at 18" o.c.
Ventilating Units Flashing	Roof Penetration	Steel.	22	Shop	Provide formed metal corners lapped 6" with sheet metal screws with neoprene washers at 18" o.c.
Valley Flashing	Metal Panel Roof	Steel.	22	Shop	Chapter 6, Similar to Fig. 6-6 or Fig. 1-21 or Fig. 1-23, Detail 10, or Fig. 6-9, Detail 7 and Chapter 4, Fig. 4-10.
Louver Screens	Louvered Openings	Steel.	14	Shop	Chapter 7, Fig. 7-7A or B. Provide 12 gauge (0.105) 3 x 3 welded wire mesh.
Plumbing Sheet Metal	Various Plumbing Conditions	Steel.	22	Shop	Refer to Plumbing Drawings and Specifications.
Mechanical Sheet Metal	Various Mechanical	Steel.	22	Shop	Refer to Mechanical Drawings and Specifications.

UTILITY SHEET METAL ITEMS					
ITEM	LOCATION	MAT.	GA.	FINISH	REMARKS / SMACNA NO., 6 <sup>th</sup> Edition
	Conditions				
Electrical Sheet Metal	Various Electrical Conditions	Steel.	22	Shop	Refer to Electrical Drawings and Specifications.
Roof and Overflow Drain Pans	Roof	Lead	#4	Shop	See Details.
Mechanical, Large Flue Flashing	Roof Penetration	Steel	22	Shop	Chapter 4, Detail 4-14A.

END OF SECTION

SECTION 07 72 00 – ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all roof accessory materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 07 40 00 METAL PANELS
  - 5. 07 51 13 BUILT-UP ROOFING
  - 6. 07 60 00 SHEET METAL
  - 7. 07 92 00 SEALANTS
  - 8. 09 91 00 PAINTING
  - 9. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ASTM American Society for Testing and Materials
    - b. LIA Lead Industries Association.
    - c. NRCA National Roofing Contractors Association (If the roofing system scheduled to be installed calls for related sheet metal flashing to be in accordance with NRCA detailing in order to satisfy their warranty requirements, then the NRCA detailing shall govern in lieu of SMACNA standards.)
    - d. OSHA Occupational Safety and Health Administration
    - e. SMACNA Sheet Metal and Air Conditioning Contractor's National Association, latest Edition, Architectural Sheet Metal Manual.

1.3 SYSTEM DESCRIPTION

- A. (Manufactured Curbs Only) This section specifies curbs for mechanical and electrical equipment specified in Division 23 and Division 26, as well as architectural curbs in Division 05, Division 07 and Division 08. These curbs are designed and fabricated as welded single piece units that are structurally designed by the manufacturer to span structural framing. The curbs require structural calculations from the manufacturer in accordance with the CBC for the mechanical or electrical units supplied that are mounted on top of the curbs.
  - 1. Manufactured curbs shall be designed, engineered, and fabricated for exact mechanical units selected after bid, and can be designed for compound slopes and difficult roofing conditions. Designs shall accommodate each type of roofing condition.
  - 2. All curbs shall be designed to be a minimum of 8-inches above the finished roof at the top most portion of the curb, and designed with crickets for watertight connections.

3. Construct curbs to match roof slopes with plumb and level top surfaces for mounting mechanical or electrical equipment.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  1. Coordination Drawings (Manufactured Curbs only):
    - a. Manufacturer(s) shall coordinate with the Contractor and the Roofing Subcontractor all applicable work placed on or penetrating the roof deck and roof membrane system for the proper selection of Roof Accessories for this project. Manufacturer shall coordinate with the Contractor all weights and dimensions from approved shop drawings of mechanical equipment and piping/conduit required for this project and fabricate accordingly. All items coordinated (including Structural Calculations) shall be presented within the shop drawings for the Architect's and Structural Engineer of Record's review.
  2. Product Data.
    - a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
    - b. Submit manufacturer's standard color range for selection by the Architect.
  3. Shop Drawings.
    - a. Submit shop drawings prepared by, or under the supervision of a registered Civil or Structural Engineer in the State of California, detailing fabrication and assembly of the work under this section, as well as procedures and diagrams. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorage to be installed as unit of work of other related sections.
      - 1) Manufactured Curbs must be coordinated with the Structural Shop Drawings and Mechanical / Electrical Equipment supplied as to size and weights for any roof top installation.
  4. Quality Assurance/Control Submittals:
    - a. Manufacturer's Written Instructions:
      - 1) Manufacturer's written instructions.
  5. Closeout Submittals in accordance with the following:
    - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
    - b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
    - c. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
    - d. Warranty in accordance with Specification Section - WARRANTIES.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications:
  1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. In accordance with Specification Section - REGULATORY REQUIREMENTS.



## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be individually wrapped.
  - 2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
- B. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Damaged products will not be accepted.
- C. Storage and protection:
  - 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.7 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. Hatch Railing System shall provide a warranty against defects in material and workmanship:
    - a. Warranty Period Five (5) Years.
      - 1) From the Date of Substantial Completion.
- C. Installer's Warranty:
  - 1. Weather Tightness Warranty for Roof Accessories: Manufacturer's Standard form in which manufacturer agrees to repair or replace Roof Accessory assemblies that fail to remain weathertight, including leaks within specified warranty period. Warranty shall guarantee manufactured Roof Accessories to be free from defects in materials or workmanship.
    - a. Warranty Period Five (5) Years.
      - 1) From the Date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MANUFACTURED CURBS

### A. General:

1. Curbs shall be constructed to match roof slope of roof and provide a level top surface for mounting of mechanical equipment.
  - a. Minimum height of all curbs shall be 8 inches above finished roof per NRCA requirements.

### B. Equipment Curbs:

1. Manufacturer: ROOF PRODUCTS, INC.
  - a. Model Number:
    - 1) Membrane Roof: RPC-5.
  - b. Acceptable alternative manufacturer: ROOF PRODUCTS & SYSTEMS CORP.
2. Factory installed pressure treated wood nailers.
3. Welded 18 gauge minimum galvanized steel shell and base plate, as applicable to roof equipment situation, with continuous mitered and welded corner seams.
4. 3 lb. density rigid fiberglass insulation board.
5. Internal angle reinforcing (1" x 1" x 12 gauge) on sides greater than 36 inches in length, spaced 24 inches o.c.
6. All welds to be coated with manufacturer's "Alumanation 100."
7. Internal curb duct supports as required for the type of Mechanical units selected for the project.

### C. Equipment Platform:

1. Manufacturer: ROOF PRODUCTS, INC.
  - a. Model Number:
    - 1) Membrane Roof: RPPF-5.
  - b. Acceptable alternative manufacturer: ROOF PRODUCTS & SYSTEMS CORP.
2. Factory installed pressure treated wood nailers.
3. Welded 18 gauge minimum galvanized steel shell and base plate, as applicable to roof equipment situation, with continuous mitered and welded corner seams.
4. 3 lb. density rigid fiberglass insulation board.
5. Internal angle reinforcing (1" x 1" x 12 gauge) on sides greater than 36 inches in length, spaced 24 inches o.c.
6. All welds to be coated with manufacturer's "Alumanation 100."
7. Internal curb duct supports as required for the type of Mechanical units selected for the project.
8. Platform Cover:
  - a. Welded 18 gauge galvanized steel construction.
  - b. Cover cross broken for positive water run-off.
  - c. Flared drip edge.
  - d. Flat Lock and Soldered seams on covers 43 inches x 105 inches and larger.
9. Platform: Provide 1-1/8" thick fire-retardant treated T & G plywood top sheathing
10. Vapor Retarder: Two layers of 15lb building paper between plywood platform and curb cover.

### D. Equipment Supports:

1. Manufacturer: ROOF PRODUCTS, INC.
  - a. Model Number:
    - 1) Membrane Roof: RPES-3.
  - b. Acceptable alternative manufacturer: ROOF PRODUCTS & SYSTEMS CORP.
2. 18 gauge minimum galvanized steel shell, base plate and counterflashing.
3. Factory installed pressure treated wood nailer.
4. Internal bulkhead re-enforcement.

5. All welded construction.
6. Vapor Retarder: Two layers of 15lb building paper between wood nailer and counterflashing.

E. Accessories:

1. Square to Round adapter as indicated on the drawings:
  - a. Cross broken for positive run-off.
  - b. Type WG 16 gauge galvanized steel construction.
  - c. Watertight construction.
  - d. Insulated to prevent condensation.
2. "Decktite" roof pipe boots in size and number applicable to the size of pipes penetrating the equipment platform indicated in the Contract Documents.
3. Fasteners as required by the manufacturer for the proper installation of the roof curbs and weather resistant coating as standard with the manufacturer.
4. Neoprene strips, sheets or washers as required by the manufacturer for weathertight construction.
5. Provide Isolation Rails as required by Mechanical in DIV. 23 or Electrical in DIV. 26.

2.3 ROOF HATCH SYSTEM

A. General: Coordinate dimensions with roughing-in information.

1. When installed on a slope, run the hinge side parallel with the slope.

B. Roof Hatch:

1. Manufacturer: BILCO COMPANY.
  - a. Model Number: Type S-50TB
  - b. Acceptable alternative manufacturer: BABCOCK DAVIS HATCHWAYS, INC.
2. Size: [30 inch x 36 inch.] [As indicated on Drawings.]
3. Cover:
  - a. Material: 11 gauge aluminum.
  - b. Insulation: 3 inch polyisocyanurate (R-value 20+).
  - c. Liner: 18 gauge aluminum.
  - d. Seal: Heavy duty EPDM, all sides.
  - e. Flange: 5 inch beaded.
4. Curb:
  - a. Material: 11 gauge aluminum.
  - b. Insulation: 3 inch polyisocyanurate (R-value 20+).
  - c. Height: Minimum height 12 inches to allow for 8 inches of vertical flashing above the finished roof. Custom heights available maximum of 24 inches.
  - d. Slope: Curb Base to match Roof Slope; refer to Drawings for Roof ASlope, Curb Top to Remain Level; typical
5. Cap Flashing: 11 gauge aluminum integral with curb, fully welded at the corners.
6. Hardware:
  - a. Material: Stainless steel.
  - b. Hinges: Heavy Pintle.
  - c. Operators: Compression springs enclosed in telescopic tubes.
  - d. Latch: Positive snap with turn handles and padlock hasps inside and outside.
  - e. Cover Seal: EPDM, all sides.
  - f. Hold-open Arms: Automatic with handle for one hand release with a 1" diameter red vinyl grip handle to permit easy release for closing.
7. Finish: Mill finish aluminum.

C. Roof Hatch Ladder Post:

1. Manufacturer: BILCO COMPANY.
    - a. Model Number: LadderUP®Safety Post LU-2.
  2. General:
    - a. Safety post shall comply with all OSHA and Cal OSHA safety guidelines for this work.
    - b. Safety Post shall be mounted so as not to interfere with the proper operation of any roof hatch covers.
  3. Performance Characteristics:
    - a. Tubular Post shall lock automatically when fully extended.
    - b. Safety Post shall have controlled upward and downward movement.
    - c. Release lever shall disengage the post to allow it to be returned to its lowered position.
    - d. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter.
    - e. If hollow rungs are encountered, provide solid bars of equal length as hollow rungs of diameter suitable for insertion into hollow rungs to prevent crushing of the rungs due to clamping of the Safety Post.
  4. Post: Hot dip galvanized finish, suitable for mounting on rear of ladder to top two rungs with clamp brackets, including all fasteners required.
    - a. All materials for Safety Post shall be in compliance with ASTM A 36, "Standard Specification for Structural Steel."
    - b. Post shall be manufactured of high strength galvanized steel square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
  5. Balancing Spring: Provide a stainless steel spring balancing mechanism to provide smooth, easy, controlled operation when raising and lowering the safety post.
  6. Hardware: Spring nuts shall be galvanized steel, and all other mounting hardware shall be Type 316 stainless steel.
- D. Roof Hatch Railing System:
1. Manufacturer: BILCO COMPANY.
    - a. Model Number: "Bil-Guard 2.0" Hatch Railing System.
  2. General:
    - a. System shall comply with the requirements of OSHA 29 CFR 1910.23 and shall meet OSHA strength requirements with a safety factor of two.
    - b. System shall attach to the capflashing of the roof hatch and shall not penetrate any roofing material.
    - c. Hinged gate shall ensure continuous barrier around roof hatch.
  3. Posts, Rails and Gate:
    - a. Material: Aluminum Schedule 40 6061 T6 alloy, 1-1/4" outside diameter.
  4. Hardware:
    - a. Gate Locking Mechanism: cast aluminum.
    - b. Hinges: Spring hinges, type 316 stainless steel, 3/8 inch thick.
    - c. Fasteners: Type 316 stainless steel.
  5. Accessories:
    - a. Provide all bolts, locknuts, washers, pins, screws, nylon washers, neoprene pads, and torsion rods, etc. required for a complete assembly.
  6. Finish: Manufacturer's powder coat.
    - a. Color: Light gray.
    - b.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

## 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface Preparation:
  - 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

## 3.3 INSTALLATION

- A. General:
  - 1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    - a. Provide Hatch Railing System on all hatches or fire vents within ten (10) feet of any roof edge) and install in accordance with manufacturer's written instructions.
  - 2. In accordance with approved submittals.
  - 3. In accordance with Regulatory Requirements.
  - 4. Set plumb, level, and square.
  - 5. Damaged products shall not be installed.
- B. Layout:
  - 1. Lines shall be straight and true.

## 3.4 FIELD QUALITY CONTROL

- A. Site Tests:
  - 1. As required by Regulatory Requirements.
- B. Inspection:
  - 1. As required by Regulatory Requirements.

2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.

### 3.5 ADJUSTING

- A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

### 3.6 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  1. Clean any soiled surfaces immediately.
  2. Finish shall be clean and ready for the application of any additional finishes.
  3. In accordance with manufacturer's written instructions and recommendations.

END OF SECTION

## SECTION 07 92 00 – SEALANTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all joint sealant materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 5. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SYSTEM DESCRIPTION

- A. Performance Requirements: It is the intention of this specification section and the drawings to form a guide for a complete and operable system. Any items not specifically noted but necessary for a complete and operable system shall be provided under this section.
  - 1. Provide elastomeric sealants for exterior applications that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
  - 2. Provide sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water-resistant and cause no staining or deterioration of joint substrates.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product data from manufacturers for each joint sealant product required.
  - 2. Shop drawings:
    - a. Provide full details of all sealants and accessories proposed for use for approval by the Architect. All materials and products proposed shall be compatible with each other and with the substrates and adjacent wall colors, and shall be non-staining and non-bleeding. Submit an affidavit from the manufacturer confirming the acceptance of the use of the selected products in the manner and on the substrates proposed.
  - 3. Samples.
    - a. Samples for initial selection purposes in form of manufacturer's bead samples, consisting of strips of actual products showing full range of colors (standard, premium and custom) available, for each product exposed to view.
      - 1) Provide color chips of adjacent wall surface colors; to be used in evaluating the sealant color samples.
  - 4. Quality Assurance/Control Submittals:
    - a. Provide UL Assembly Classification appropriate for each fire rated penetration.
    - b. Certificates:

- 1) Submit three (3) copies of certificates.
  - a) Certification by each joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
  - b) Certified test reports for elastomeric sealants on aged performance as specified, including hardness stain resistance, adhesion, cohesion or tensile strength, elongation, low temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) and heat and exposure to ozone and ultra violet light. Adhesion data shall include long-term adhesion characteristics of all adhesion surfaces including silicone, aluminum and glass coatings and long term weathering test on the silicone on contact with similar materials.
  - c) Certificate of Installation: Signed by the installer and sealant manufacturer stating that sealant installed complies with specifications, and that installation methods comply with manufacturer's printed instructions for each condition of installation and use on the project. The sealant installer shall have no less than five years of continuous experience in installing the specified products. Their experience shall include similar work to this subject project. In addition, the manufacturers will provide written approval of the material installers.
- c. Manufacturer's Written Instructions:
  - 1) Submit three (3) copies of manufacturer's written instruction
- d. Closeout Submittals in accordance with Specification Sections in Division One:
- e. Warranty in accordance with Specification Section - WARRANTIES.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  1. Material Qualifications:
    - a. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
  2. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  3. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units and colors without causing delay in the work.
- B. Regulatory Requirements:
  1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. AAMA American Architectural Manufacturer's Association
      - 1) AAMA 800-92 - "VOLUNTARY SPECIFICATIONS AND TEST METHODS FOR SEALANTS.
    - b. ASTM American Society for Testing and Materials.
      - 1) ASTM C 1193 - "STANDARD GUIDE FOR USE OF JOINT SEALANTS."
    - c. CA-CHPS California High Performance Schools
    - d. GANA Glass Association of North America, 1997 Edition of the Glazing Manual, and the most recent Edition of the Sealant Manual.



- e. SWRI Sealant Waterproofing Restoration Institute - Types of standards as found in Chapter III "Sealants: The Professionals' Guide."

C. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with all other related work.
  - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
  - b. Maintain installed work until the Notice of Substantial Completion has been executed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
  1. Comply with the Sealant Requirements of the GANA Glazing Manual and GANA Sealant Manual.
- B. Store and handle materials in compliance with manufacturer's written recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
  1. Store sealant containers in a protected location in accordance with their manufacturer's printed instructions until their use.

1.6 PROJECT CONDITIONS

- A. Environmental requirements:
  1. Apply materials within manufacturer's written recommended surface and ambient temperature ranges.
  2. Apply materials when working joints are most likely to be normal size.
  3. Do not install sealants under adverse weather conditions, or when temperatures are beyond manufacturer's written recommended limits.
    - a. Proceed with the installation only when forecasted weather conditions are favorable for proper sealant cure, and development of early bond strength. Allow a minimum of three days after rain.
    - b. Where joint width is affected by ambient temperature variations, install sealants only when temperatures are in the lower third of manufacturer's written recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at low temperatures.

1.7 WARRANTY

- A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with Specification Section - WARRANTIES.
  2. Manufacturer shall warrant exterior joint sealant after substantial completion of work.
    - a. Warranty Period Ten (10) Years.
- C. Installer's Warranty:
  1. Sealant Contractor shall warrant sealants against defective materials and workmanship after substantial completion of work.
    - a. Warranty Period Five (5) Years.
    - b. Warranty shall further state that installed sealants are warranted against the following:
      - 1) Water leakage through sealed joints.
      - 2) Adhesive or cohesive failure of sealant.
      - 3) Staining of adjacent surfaces caused by migration of primer or sealant.
      - 4) Chalking or visible color change of the cured materials.
    - c. The installer shall make repairs during the warranty period at no cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Specified product manufacturer, or approved equivalent:
    - a. One-Part Neutral Cure Silicone Sealant:
      - 1) PECORA "#890"
        - a) NOTE: For continual immersion in water conditions, provide PECORA "Dynatred".
        - b) If the water contains a chlorine content of 5ppm, then PECORA "Synthacalk GC2+" shall be used.
      - 2) Acceptable alternative manufacturers for 1) only above:
        - a) BONDAFLEX "Sil 290"
        - b) DOW PERFORMANCE SILICONES "#790"
        - c) SONNEBORN "Sonolastic 150" or "Sonolastic 150 VLM"
    - b. One-Part Acid-Curing Silicone Sealant:
      - 1) PECORA "#860"
      - 2) Acceptable alternative manufacturers:
        - a) BONDAFLEX "Sil 100 GP"
        - b) DOW PERFORMANCE SILICONES "#999-A"
        - c) SONNEBORN "Omniplus"
    - c. One-Part Mildew-Resistant Silicone Sealant:
      - 1) PECORA:

- a) White Color Only "#345"
- b) Available in multiple colors for selection "#898"
- 2) Acceptable alternative manufacturers to 1), a), above:
  - a) BONDAFLEX "Sil 100 WF"
  - b) DOW PERFORMANCE SILICONES "#786"
  - c) SONNEBORN "Omniplus"
- d. One-Part Gun Grade Urethane Sealant:
  - 1) PECORA "Dynatrol I-XL"
  - 2) Acceptable alternative manufacturers:
    - a) BONDAFLEX "Pur 25" or "Pur 25 Tex"
    - b) SIKA "Sikaflex 1a" or "Sika Textured"
    - c) SONNEBORN "NP1 Smooth" or "X1 Textured"
    - d) VULKEM "#116"
- e. Multi-Component Gun Grade Urethane Sealant:
  - 1) PECORA "Dynatred"
  - 2) Acceptable alternative manufacturers:
    - a) BONDAFLEX "Pur 2 NS"
    - b) SIKA "Sikaflex 2c NS"
    - c) SONNEBORN "NP2"
- f. Multi-Component Gun Grade Urethane Sealant (Fast Curing):
  - 1) PECORA "Dynatred"
  - 2) Acceptable alternative manufacturers:
    - a) BONDAFLEX "Pur 2 NS"
    - b) SIKA "Sikaflex 2c NS"
    - c) SONNEBORN "NP2" with manufacturer's accelerator.
    - d) VULKEM "#227"
- g. One-Part or Multi-Component Gun Grade Urethane Sealant (Security Sealant) :
  - 1) PECORA "Dynaflex"
  - 2) Acceptable alternative manufacturers:
    - a) BONDAFLEX "Pur 2 NS"
    - b) SIKA "Sikaflex 2c NS TG"
    - c) SONNEBORN "Ultra"
- h. One-Part Pourable Self-Leveling Urethane Sealant:
  - 1) PECORA "Urexpan NR-201" or "Dynatred"
  - 2) Acceptable alternative manufacturers:
    - a) BONDAFLEX "Pur 35 SL"
    - b) SIKA "Sikaflex 1c SL"
    - c) SONNEBORN "Sonolastic SL 1"
    - d) VULKEM "#45"
- i. Multi-Component Pourable Self-Leveling Urethane Sealant (Fast Curing):
  - 1) PECORA "Urexpan NR-200"
  - 2) Acceptable alternative manufacturers:
    - a) BONDAFLEX "Pur 2 SL"

- b) SIKA "Sikaflex 2c SL"
    - c) SONNEBORN "Sonolastic SL 2"
    - d) VULKEM "#245/255"
  - j. Acrylic-Emulsion Sealant:
    - 1) PECORA "AC-20"
    - 2) Acceptable alternative manufacturers:
      - a) BONDAFLEX "Sil-A 700"
      - b) SONNEBORN "Sonolac"
  - k. One-Part Butyl Sealant:
    - 1) PECORA "BC-158"
    - 2) Acceptable alternative manufacturers:
      - a) PTI (by H.B. FULLER) "#707"
  - l. Acoustical Sealant:
    - 1) PECORA:
      - a) Exposed and Fire Rated areas; Pecora "AC-20 FTR"
      - b) Concealed areas: Pecora "AIS-919"
    - 2) Acceptable alternative manufacturers:
      - a) BONDAFLEX "Sil-A 700"
      - b) OSI "GRABBER" #GSCS
      - c) TREMCO INC. 834
      - d) W.W. HENRY "#413"
  - m. Firestop Sealants: Use in designated Fire-Rated Assemblies in accordance with approved UL Classified Assemblies.
    - 1) HILTI
    - 2) Acceptable alternative manufacturers:
      - a) 3M
      - b) PECORA
  - n. Firestop Putty Pads: Use in Fire-Rated Assemblies where penetration holes are too large for caulk, in accordance with approved UL Classified assemblies:
    - 1) HEVI-DUTY / NELSON "Putty Pads"
  - o. Glazing Tape Sealants:
    - 1) Butyl Glazing Tape:
      - a) PECORA "Extru-Seal"
      - b) Acceptable alternative manufacturers:
      - c) TREMCO, INC. "440 Tape"
    - 2) Butyl Pressure Glazing Tape:
      - a) PECORA "Dyna-Seal"
  - p. Pre-Compressed Foam Sealants:
    - 1) EMSEAL CORP. "Emseal"
  - q. Sheet Caulking (Electrical Junction Box Sealers):
    - 1) LOWRY "Electrical Box Sealer"
    - 2) Acceptable alternative manufacturer:
      - a) TREMCO INC. "Sheet Caulking"
  - r. EIFS preformed paintable Urethane Tape:
    - 1) SIKA "Sikaflex PUR" Tape System
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

### A. General:

1. Compatibility: Provide sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - a. Colors: Provide color of exposed sealants to comply with the following:
    - 1) Sealant colors shall match adjacent wall color.
    - 2) Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

### B. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants (Silicones, Urethanes, and Acrylics) that comply with ASTM C 920 "Specification for Elastomeric Joint Sealants," and other requirements indicated on each Elastomeric Joint Sealant listed, including those requirements referencing ASTM C 920 "Specification for Elastomeric Joint Sealants," classifications for Type, Grade, Class, and Uses.

1. Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint Sealant listed, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719 "Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)," to withstand the specified percentage change in the joint width existing at time of installation.

### C. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 "Specification for Latex Sealants," that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

### D. Butyl Sealant: Manufacturer's standard one-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1311 "Standard Specification for Solvent Release Sealants," and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

### E. Acoustical Sealant: Manufacturer's non-drying, non-bleeding and non-hardening butyl sealant complying with ASTM C 834 "Specification for Latex Sealants," and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90 "Test method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements."
2. For fire rated conditions, use an acoustical sealant that has at least Class II Flame Spread and Smoke Developed ratings in accordance with ASTM E-84 "Test method for Surface Burning Characteristics of Building Materials," as follows:
  - a. Flame Spread Rating 53.
  - b. Smoke Developed Rating 117.

### F. Firestop Pillows / Bags: In accordance with UL Classified systems. Reusable, heat-expanding pillows / bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

### G. Firestop Sealants: In accordance with ASTM E 814 "Specification for Latex Sealants," and ANSI/UL 1479 Classified systems.

1. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
2. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

## 2.3 ACCESSORIES

- A. Tape: Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.
- B. Pre-compressed Foam: Manufacturer's standard preformed, pre-compressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in pre-compressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:
  - 1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with joint substrates and other sealants.
  - 2. Impregnating Agent: Manufacturer's standard.
  - 3. Density: Manufacturer's standard.
  - 4. Backing: Pressure-sensitive adhesive factory applied to one side with protective wrapping.
- C. Backing Rods (Joint Sealant Backing):
  - 1. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
  - 2. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
    - a. Open-cell polyurethane foam.
    - b. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
    - c. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
    - d. Any material indicated above.
  - 3. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
  - 4. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
  - 5. Acoustical Sheet Caulking for junction boxes: LOWRY'S Electrical Box Sealer, or TREMCO INC. sheet caulking
- D. Miscellaneous Materials:
  - 1. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
3. Masking Tape: Non-staining, nonabsorbent material compatible with sealants and surfaces adjacent to joints. Use the type of masking tapes available that is compatible to the substrate being masked without damaging the surface material of finish when removed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which, affect the execution of work under this specification section.
  2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
  1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  3. Remove laitance and form release agents from concrete.
  4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
  1. Masking Tape: Use the appropriate masking tape (type selected to the substrate so as not to mar the surface it is protecting) where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION

#### A. General:

1. Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 "Standard Guide for Use of Joint Sealants," for use of sealants as applicable to materials, applications, and conditions indicated.
  - a. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 "Practice for Use of Sealants in Acoustical Applications," as applicable to materials, applications, and conditions indicated.
  - b. Use Urethane Sealants at painted joints.
  - c. Use Silicone Sealants at exposed, non-painted joints.
  - d. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
    - 1) Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability
      - a) Do not leave gaps between ends of joint fillers.
      - b) Do not stretch, twist, puncture, or tear joint fillers.
      - c) Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
    - 2) Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
  - e. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
    - 1) For normal moving joints not subject to traffic: Fill joints to a depth equal to 50% of joint width, but not less than 1/4" deep or more than 1/2" deep. In no case shall the applied sealant width exceed the sealant depth.
    - 2) Assure that the *bond line* surface is a minimum of 1/4" wide. Install approved backer material at a proper depth to provide sealant bead profiles as detailed on approved shop drawings. Backer material shall be of appropriate size and shape and shall be compressed between 25% and 50% when installed.
    - 3) Backer material may not be modified in-lieu of using the properly dimensioned material. Install, when required a polyethylene, or other approved, bond backer tape to provide sealant bead profiles as detailed on approved shop drawings.
  - f. Do not allow sealants, primers, or other compounds to overflow, spill or migrate into voids of adjacent construction.
  - g. Remove excess sealant spillage promptly as this work progresses. Clean adjacent surfaces by recommended means to remove sealant, but not damage the surfaces. Remove all cartons and debris from the site as the work progresses and at the end of each work day. Joints shall be prepared and sealed on the same working day.



- h. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
  - 1) Provide concave joint configuration per Figure 5A in ASTM C 1193 "Standard Guide for Use of Joint Sealants," unless otherwise indicated.
  - 2) Provide flush joint configuration, per Figure 5B in ASTM C 1193 "Standard Guide for Use of Joint Sealants," where indicated.
    - a) Use masking tape to protect adjacent surfaces of recessed and tooled joints.
  - 3) Provide recessed joint configuration, per Figure 5C in ASTM C 1193 "Standard Guide for Use of Joint Sealants," of recess depth and at locations indicated.
- i. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's written directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's written recommendations.
- j. Acoustical Sealant Applications:
  - 1) Provide acoustical sealant to form an airtight seal at all penetrations and perimeter of sound-rated partitions, floors and ceilings. Comply with requirements of specification section titled Gypsum Board. Use backer-rod where gaps to be sealed exceed 3/8 inches.
  - 2) Provide sheet caulking to seal the back and sides of all junction boxes (4 gang and smaller) recessed in acoustically-rated partitions.
  - 3) Provide acoustical sealant as a continuous bead along gypsum board face layer at all head and sill conditions of sound-rated partitions and around the perimeter of resilient ceilings.
- k. Firestop Sealants: In accordance with applicable UL Classified numbers compatible with products provided.

### 3.4 CLEANING

- A. Clean in accordance with Specification - PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces immediately.
  - 2. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated sealants immediately so that and installations with repaired areas are indistinguishable from original work.

## 3.6 SCHEDULES

## A. Sealant Schedule:

## B. Sealants: Description of joint construction and location where sealant is typically applied

1. One-Part Neutral Cure Silicone Sealant:
  - a. Exterior and interior joints in vertical surfaces of concrete and masonry.
  - b. Between concrete masonry and stone.
  - c. Between metal and concrete, mortar, and stone.
  - d. Interior and exterior perimeter joints of metal frames in exterior walls.
  - e. Exterior overhead joints.
  - f. Use the applicable sealant for continual immersion in water applications, such as swimming pools, fountains and cooling towers – USDA Approved.
2. One-Part Acid-Curing Silicone Sealant:
  - a. Exposed joints within glazed curtain wall framing systems, skylight framing systems, and aluminum entrance framing systems, if applicable.
3. One-Part Mildew-Resistant Silicone Sealant:
  - a. White Grout Joints: Provide white silicone sealant material to match adjacent white grout joints in interior joints in vertical surfaces of ceramic tile in toilet rooms, showers, and kitchens.
  - b. Colored Grout Joints: Provide colored silicone sealant material to match adjacent colored grout joints in interior joints in vertical surfaces of ceramic tile in toilet rooms, showers, and kitchens.
4. One-Part Gun Grade Urethane Sealant:
  - a. Exposed joints in pre-cast, masonry, window frame perimeters and similar types of construction joints.
5. Multi-Component Gun Grade Urethane Sealant:
  - a. Control joints and window and door perimeters.
6. Multi-Component Gun Grade Urethane Sealant (Fast Curing):
  - a. Plaza Decks.
7. One-Part or Multi-Component Gun Grade Urethane Sealant (Security Sealant):
  - a. Control joints and window and door perimeters where sealant is exposed to physical abuse.
8. One-Part Pourable Self-Leveling Urethane Sealant:
  - a. Exterior and interior joints in horizontal surfaces of concrete.
  - b. Exterior and interior joints in horizontal surfaces between metal and concrete, mortar, stone, and masonry surfaces.
9. Multi-Component Pourable Self-Leveling Urethane Sealant (Fast Curing):
  - a. For use when walking surfaces require use within 24 hours of application without damage to joint surfaces.
  - b. Exterior and interior joints in horizontal surfaces of concrete.
10. Acrylic-Emulsion Sealant:
  - a. Paintable joints for the following surfaces expected to receive field painting:
    - 1) Interior joints in vertical and overhead surfaces at perimeter of elevator door frames and door frames (not requiring security grade sealant).
    - 2) Interior joints in gypsum board, plaster, concrete, and concrete masonry.
    - 3) All other interior field paintable joints not indicated otherwise.
11. One-Part Butyl Sealant:
  - a. Primarily used for glazing seals where little or no movement is expected.
12. Acoustical Sealant:

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- a. Joints to control dust, air, smoke and sound transmission, including under all exterior wall sill plates placed on top of Cast-In-Place Concrete slabs.
- 13. Firestop Sealants:
  - a. In fire-rated walls, compatible with wall ratings and in accordance with applicable penetration types in walls and floors, and in accordance with UL Classified numbers.

END OF SECTION

## SECTION 08 11 00 – METAL DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to fabricate and install all Custom Metal Door Panels and Metal Frame materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    - a. Fire-Rated and Smoke-Rated Assemblies.
  - 2. Provide all material, labor, equipment and services necessary to fabricate and install Temperature Rise Fire-Rated Assemblies.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 15 14 DRILLED ANCHORS
  - 4. 03 30 00 CAST-IN-PLACE CONCRETE
  - 5. 05 12 00 STEEL AND FABRICATIONS
  - 6. 07 40 00 METAL PANELS
  - 7. 07 60 00 SHEET METAL
  - 8. 07 92 00 SEALANTS
  - 9. 08 70 00 HARDWARE
  - 10. 08 80 00 GLASS
  - 11. 09 24 00 CEMENT PLASTER
  - 12. 09 29 00 GYPSUM BOARD
  - 13. 09 30 00 TILE
  - 14. 09 68 40 CARPET
  - 15. 09 91 00 PAINTING
  - 16. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 17. 10 14 00 IDENTIFYING DEVICES
  - 18. SPECIFICATION SECTIONS IN THE FACILITY SERVICE SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ANSI American National Standards Institute
    - b. ASTM American Society of Testing and Materials
    - c. AWS American Welding Society
    - d. HMMA Hollow Metal Manufacturers Association (Division of NAAMM)
    - e. NAAMM National Association of Architectural Metal Manufacturers
    - f. NFPA National Fire Protection Association
    - g. NILECJ National Institute of Law Enforcement and Criminal Justice
    - h. UL Underwriter's Laboratory, Inc.
    - i. USSG U.S. Standard Gages
    - j. WH Warnock Hersey International

### 1.3 DEFINITIONS

- A. Minimum Thickness: Base metal thickness without coatings.
- B. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI / NAAMM-HMMA.
- C. Glazing Molding: Portion of the assembly retaining glazing materials or in-fill panels in a hollow metal door which contain the integral glazing stop, or to which a glazing stop is attached.
- D. Glazing Stop: A formed metal section used to secure glazing in a door or frame.
- E. Prepared Opening: Existing opening or wall constructed prior to installation of frames.

### 1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
  - 1. Metal Door and Frame Assemblies.
    - a. All Doors shall be custom in accordance to NAAMM-HMMA Standards for Hollow Metal Doors.
    - b. All Frames shall be custom in accordance to NAAMM-HMMA Standards for Hollow Metal Frames.
  - 2. Fire Rated Assemblies:
    - a. Door and Frame Assemblies shall be custom in accordance to NAAMM-HMMA Standards for Fire-Rated Hollow Metal Doors and Frames and shall comply with all of the requirements for Doors and Frames.
    - b. Conform to the requirements of CBC, Chapter 7 "Fire and Smoke Protection Features".
      - 1) Fire-Rated Door Assemblies shall comply with NFPA 252 "Standard Methods of Fire Tests of Door Assemblies" and UL 10C "Positive Pressure Fire Tests for Door Assemblies."
      - 2) Fire-Rated Window Assemblies shall comply with NFPA 257 "Fire Testes for Fire Window Assemblies and Glass Block Assemblies," NFPA 80 "Standard for Fire Doors and Other Opening Protectives," and UL 9 "Fire Tests of Window Assemblies."
      - 3) Fire-Rated Door Assemblies shall also meet the requirements for a Smoke and Draft Control Door Assembly, complying with UL 1784 "Air Leakage Tests for Door Assemblies."
      - 4) Fire-Rated Doors and Frames shall be labeled by an DSA/FLS approved agency and shall comply with NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and UL 1784 "Air Leakage Test for Door Assemblies."
    - c. All Fire-Rated Doors are to be positive latching and self or automatic closing in accordance with NFPA 80 "Standard for Fire Doors and Other Opening Protectives."
    - d. All Fire-Rated Assemblies shall be provided with approved gasketing material, so installed as to provide a seal where the door meets the stop on both sides and across the top.
      - 1) Continuous Hinges, Seals, etc. shall not obscure ratings of doors or door frames.

## 1.5 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
  - 1. Contractor shall check all drawings and verify all dimensions (including wall thickness) in the field prior to fabrication.
  - 2. Contractor shall verify that shop drawings include all required materials and material clearances.
- B. Product Data:
  - 1. Include construction details, material descriptions, core descriptions, label compliance, fire-resistance ratings, temperature-rise ratings, and finishes for each type of product indicated.
    - a. Provide information indicating all the Structural Properties of the steel materials.
- C. Shop Drawings:
  - 1. Include, but not limited to, the following information:
    - a. Elevations of each door design and frame configuration.
    - b. Details of doors, including vertical and horizontal edge details.
    - c. Frame details for each frame type, including dimensioned profiles.
    - d. Details and location of reinforcement and preparations for hardware.
    - e. Details of each different wall opening condition.
    - f. Details of anchorages, joints, field splices, and connection.
    - g. Details of accessories.
    - h. Details of moldings, removable stops, and glazing.
    - i. Details of louvers, including sizes and location in doors, where required.
    - j. Details of conduit and preparations for power, signal, and control systems.
  - 2. Provide a Schedule, prepared by or under the supervision of supplier for doors, panels, and frames using same reference numbers for details and openings as those on the Drawings.
    - a. Coordinate with door hardware schedule.
  - 3. Provide setting drawings, templates, and directions for installing anchorage, including sleeves, concrete inserts, anchors, bolts, and items with integral anchors for installation coordination.
  - 4. Manufacturer's printed instructions for preparation, installation and care requirements for installers and inspecting authorities.
- D. Samples:
  - 1. When factory applied color is indicated, provide manufacturer's full range of factory applied color finishes for selection.
  - 2. Provide typical frame joint section and sample showing typical edge condition specified.
  - 3. When Stainless Steel is indicated, provide samples of 3 inches by 5 inches for each type of exposed finish required.
    - a. Frames: Provide fabrication samples of profile and corner joints.
    - b. Doors: Provide fabrication sample of corner showing vertical edges and top.
- E. Quality Assurance/Control Submittals:
  - 1. Design Data:
  - 2. Test Reports:

- a. Product Test Reports based on evaluation of comprehensive test performed by a qualified testing agency, for each type of fire-rated metal door, panel, and frame assembly.
    - b. Water Tightness Test Reports.
  - 3. Certificates:
    - a. Oversized Construction Certification.
    - b.
- F. Closeout Submittals in accordance with the following:
  - 1. General Construction Warranty.
  - 2. Workmanship and Materials Warranty.

#### 1.6 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.
- C. Coordinate locations of door glazing with door hardware items.

#### 1.7 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:
    - a. Fire-Rated Door and Frame Assemblies shall be labeled by an DSA/FLS approved agency and shall comply with NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and UL 1784 "Air Leakage Test for Door Assemblies."
    - b. Oversized Door Assemblies required to be fire rated and exceeds the limitations of labeled assemblies, a certificate of inspection shall be furnished by an approved testing agency in lieu of an Oversized Fire Door Label.
  - 2. Installer Qualifications:
    - a. Installer shall be experienced and shall have successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    - b. Installer(s) shall have participated in mock-up installation that was successfully tested for water tightness.
  - 3. Manufacturer/Supplier Qualifications:
    - a. Manufacturer/Supplier shall have successfully produced/supplied products similar to that required for this Project, and shall have sufficient production/supply capacity to produce/supply required units without causing delay in the work.
    - b. Manufacturers must be members of the HMMA, who have been engaged for at least two years in the production for sale of swing steel doors and frames on a national basis.
      - 1) All doors and frames shall be manufactured and supplied by the same manufacturer.
- B. In accordance with Specification Section - Regulatory Requirements.
- C. :
- D. Mock Ups:

1. Provide Mock-Ups prior to application of the final layer of the finished exterior wall material and prior to installation of any exterior wall cavity and interior materials.
  2. Metal Frame Assembly:
    - a. Mock-Ups shall be of each type of opening assembly in every type of exterior wall assembly in which an opening occurs, shall integrate all other related work assemblies and shall be representative of the intended end use configuration.
      - 1) Provide a Mock-Up with a minimum opening size of 24 inches square for window opening.
    - b. Mock Ups will be used for establishing construction sequence, and installation requirements of materials, and creating water tight assemblies.
    - c. Mock-Ups may become part of the completed Work upon successful testing for water tightness.
  3. Installation:
    - a. The Project Inspector, the Architect, Contractor's Superintendent and Sub-contractor's Superintendent shall observe the installation of materials.
    - b. Installation crew for the Mock-Ups shall be the installers of the metal frame systems for this project and installers, as necessary, of other related work assemblies.
    - c. Mock Ups shall include the installation of integral flashing, glazing, louvers, sheet metal flashing, sealants, water barriers and penetration flashing of exterior material systems and other materials of related work that makes the openings watertight.
    - d. Failed Mock Ups shall be removed and the assembly reinstalled until the water tightness test is successful.
- E. Meetings:
1. Pre-Installation: Scheduled by Contractor prior to the start of work.
    - a. Coordinate the work with all other related work.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
    - b. Establish protection procedures to maintain installed work until the Notice of Substantial Completion has been executed.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
1. Doors and Frames shall be palletized, wrapped, or crated to provide protection during transit and Project-Site storage. Do not use non-vented plastic.
    - a. Provide additional protection to prevent dents, scratches and other damage.
- B. Acceptance at Site:
1. Do not deliver doors and frames to project site until Installer is ready and the site conditions will accommodate the installation of frames.



2. Damaged products will not be accepted.

C. Storage and Protection:

1. Storage and protection shall be in accordance with NAAMM-HMMA 840 Standard, "Installation and Storage of Hollow Metal Doors and Frames."
2. Store Doors and Frames under cover at Project Site. Stored on level platforms, minimum six (6) inches above ground, allowing air circulation under stacked units.
  - a. Doors and Frames shall be placed in the up-right position, spaced by blocking to allow ventilation between units.
  - b. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

1.9 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - a. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions for the fabrication of custom frames. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.10 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. Doors and Frames in accordance with manufacturer's written standard warranty:
  - a. Warranty Period One (1) Year.

C. Installer's Warranty:

1. Issue to the Owner a warranty against defective workmanship and materials.
  - a. Warranty period Four (4) Years.
  - b. In accordance with the terms of the Specification Section - WARRANTIES.
  - c. Warranty shall include the responsibility for the repairs of any failure that is the result of defects in materials and workmanship.
  - d. Warranty shall certify that the installation of all exterior Metal Doors and Frames were done in accordance with the method and procedures established with the successful Mock-Up for water tightness.
  - e. The Warranty shall be co-endorsed by the General Contractor, the Metal Door and Frame Material Manufacturer, the Metal Door and Frame Installer and Glazing Installer.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Custom Metal Doors and Frames:
    - a. SECURITY METAL PRODUCTS CORPORATION.
    - b. Acceptable alternative manufacturers:
      - 1) CURRIES COMPANY.
      - 2) METAL MANUFACTURING CO., INC.
      - 3) STILES CUSTOM METAL, INC.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Commercial Steel (CS), Type B, conforming with ASTM A 1008/A 1008M "Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable." Steel shall be suitable for exposed to view applications.
- B. Hot-Rolled Steel Sheet: Commercial Steel (CS), Type B, conforming with ASTM A 1011/A 1011M "Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength." The steel shall be pickled and oiled, free of scale, pitting, coil-breaks or other surface defects.
- C. Metallic-Coated Steel Sheet: Commercial Steel (CS), Type B, complying with ASTM A 653/A 653M "Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process." The steel shall have a-minimum G60 (Z180) zinc (galvanized) or A60 (ZF 180) zinc-iron-alloy (galvannealed) coating designation.
- D. Stainless Steel Sheet: Complying with ASTM A 666 "Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar."
- E. Inserts, Bolts and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M "Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware."
- F. Grout:
  - 1. Concrete Walls: Comply with ASTM C476 "Standard Specification for Grout for Masonry," with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M "Standard Test Method for Slump of Hydraulic-Cement Concrete."
  - 2. Masonry Walls: Mortar comply with Specification Section - CONCRETE MASONRY UNITS.
- G. Insulation:

1. Mineral-Fiber Insulation: ASTM C 665 "Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing," Type I (blankets without membrane facing): consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 "Test method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C," for combustion characteristics.
    - a. Fire Rated Doors and Frames: Provide insulation that provides fire protection and/or temperature rise ratings as indicated.
  2. Expanded Foam Insulation suitable for injection into frame cavity.
    - a. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
  3. Exterior Doors: Provide core with thermal polyisocyanurate insulation cores.
  4. Exterior Door Frames: Solidly packed mineral insulation.
  5. Insulation for Miscellaneous work:
    - a. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Sealants: Comply with Specification Section – SEALANTS.
1. Sealants shall be compatible with glazing and frames.

## 2.3 MANUFACTURED UNITS

- A. General:
1. Exterior Doors and Frames: In accordance with NAAMM-HMMA Standard 862, "Guide Specifications for Commercial Security Hollow Metal Doors and Frames," Class IV Door in accordance with NILECJ-STD-0306.00.
  2. Interior Doors and Frames: In accordance with NAAMM-HMMA 861 Standard, "Guide Specifications for Commercial Hollow Metal Doors and Frames," unless otherwise indicated in the Contract Documents.
- B. Doors:
1. Design shall be custom seamless hollow construction in the flush type variations as indicated.
    - a. Thickness 1-3/4 inch.
  2. Face Sheets:
    - a. Exterior Doors shall be fabricated from Metallic-Coated Steel Sheets with zinc-iron-alloy (galvannealed) coating designation.
      - 1) Exterior Doors 14 gage minimum.
    - b. Interior Doors shall be fabricated from Cold-Rolled Steel Sheets.
      - 1) Interior Doors 18 gage minimum.
  3. Core:
    - a. Steel Stiffened with continuous vertical formed steel sections fabricated from same materials as face sheets.
      - 1) Exterior Door 18 gage minimum.
      - 2) Interior Door 22 gage minimum.
    - b. Spaces between stiffeners shall be insulated the full height of the door.
  4. Top and Bottom Edges:
    - a. Close with continuous recessed and flush filler channels fabricated from same material as face sheets.

- 1) Exterior Door 12 gage minimum.
    - 2) Interior Door 16 gage minimum.
  - b. All doors shall have an additional flush filler channel at top and flush filler channel at bottom edges, unless recess channel at bottom is required for hardware.
  - c. All channels shall be fabricated from same material as face sheets.
5. Jamb Edges:
- a. Reinforce with continuous "U" channels fabricated from same material as face sheets.
    - 1) Exterior Door 12 gage minimum.
    - 2) Interior Door 16 gage minimum.
  - b. All channels shall be galvanized at exterior doors.
  - c. Astragals shall be fabricated from same material as face sheets. 14-gage minimum.
6. Hardware Reinforcements:
- a. Exterior Doors: Reinforcing Plates shall be fabricated from the same material as the face sheets in the minimum thickness as follows:
    - 1) Hinges and Pivots 1/4" plate.
    - 2) Continuous hinges 14-gage.
    - 3) Mortise Hardware 7-gage.
    - 4) Locks, Exit Devices, Flush Bolts, Concealed Holders, Concealed Hardware or Surface-Mounted Closures 12-gage.
    - 5) Pull Plates, Bars and all other Surface-Mounted Hardware 12-gage.
  - b. Interior Doors: Reinforcing Plates shall be fabricated from the same material as the face sheets in the minimum thickness as follows:
    - 1) Hinges and Pivots 7-gage.
    - 2) Continuous Hinges 14-gage.
    - 3) Mortise Hardware 10-gage.
    - 4) Locks, Exit Devices, Flush Bolts, Concealed Holders, Concealed Hardware or Surface-Mounted Closures 12-gage.
    - 5) Pull Plates, Bars and all other Surface-Mounted Hardware 16-gage.
7. Glazing Moldings and Stops:
- a. Fabricate from the same material as the door face sheets.
    - 1) Exterior Doors 16-gage minimum.
    - 2) Interior Doors 20-gage minimum.
8. Door Louvers: In accordance with NAAMM-HMMA Standard 810 "Hollow Metal Doors" and fabricate from the same material as the door face sheets.
- a. Exterior Doors:
    - 1) Internal Channels 12-gage minimum.
    - 2) Vanes 12-gage minimum.
      - a) Reinforcement 0.25inch x 1.5 inch minimum.
    - 3) Insect Screens 12-gage minimum.
  - b. Interior Doors:
    - 1) Internal Channels 16-gage minimum.
    - 2) Vanes 18-gage minimum.
      - a) Reinforcement 0.25inch x 1.5 inch minimum.
  - c. Fire-Rated Doors:

- 1) Movable vanes closed by actuation fusible link and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated.
- d. Non-Rated Doors: Provide sightproof louver of stationary vanes of inverted "Y" Type blade construction with a 30 percent free area, unless noted otherwise.

C. Frames:

1. Design shall be custom seamless hollow construction in the variety of configurations as indicated.
2. Exterior Frames shall be fabricated from Metallic-Coated Steel Sheets with zinc-iron-alloy (galvannealed) coating designation.
  - a. All Opening sizes 12-gage minimum.
3. Interior Frames shall be fabricated from Cold-Rolled Steel Sheets.
  - a. Openings 4'-0" or less 16-gage minimum.
  - b. Openings greater than 4'-0" 14-gage minimum.
4. Glazing Stops shall be fabricate from the same material as Frames.
  - a. Exterior Frames 16-gage minimum.
  - b. Interior Frames 20-gage minimum.
5. Internal Frame Stiffeners shall be fabricated from the same material as Frames.
  - a. Head of Frames 12-gage.
6. Internal Reinforcing Tabs shall be fabricate from the same material and gage thickness as Frame.
7. Hardware Reinforcements:
  - a. Exterior Frames: Reinforcing Plates shall be fabricated from the same material as the Frame in the minimum thickness as follows:
    - 1) Hinges and Pivots 1/4" plate full width of frame x 10".
    - 2) Continuous Hinges 14-gage full width of frame x entire frame length.
    - 3) Strike Hardware 7-gage.
    - 4) Flush Bolts 7-gage.
    - 5) Closers 7-gage.
    - 6) Surface-Mounted Hardware 7-gage.
    - 7) Hold-Open Arms 7-gage.
    - 8) Surface Panic Devices 7-gage.
  - b. Interior Frames: Reinforcing Plates shall be fabricated from the same material as the Frame in the minimum thickness as follows:
    - 1) Hinges and Pivots 7-gage full width of frame x 10".
    - 2) Continuous Hinges 14-gage full width of frame x entire frame length.
    - 3) Strike Hardware 12-gage.
    - 4) Flush Bolts 12-gage.
    - 5) Closers 12-gage.
    - 6) Surface-Mounted Hardware 12-gage.
    - 7) Hold-Open Arms 12-gage.
    - 8) Surface Panic Devices 12-gage.

D. Frame Anchors:

1. Exterior Frames: Frame Anchors shall be fabricated from Metallic-Coated Steel Sheets, unless indicated otherwise.

- a. Stud Frame Walls 16-gage Combination Wood/Steel Stud Anchors.
  - 1) Anchor shall be not less than 2" wide x 10" long.
- b. Jamb Base 14-gage Fixed Floor Anchors.
- c. Floor Base 14-gage Existing Wall Anchors.
  - 1) Where indicated 14 gage continuous Rough Buck Anchors.
  - 2)
- 2. Interior Frames: Frame Anchors shall be fabricated from Cold-Rolled Steel Sheets or Hot-Rolled Steel Sheets, unless indicated otherwise.
  - a. Wood Stud Frame Walls 18 gage Wood Stud Anchors.
    - 1) Anchor shall be not less than 2" wide x 10" long.
  - b. Jamb Base 14-gage Fixed or Adjustable Floor Anchors.
  - c. Floor Base 16 gage Existing Wall Anchors.
    - 1) Where indicated 16 gage Fixed Mullion Anchors.
    - 2) NOTE: PLEASE KEEP PREPARED OPENINNGS...
- E. Fasteners:
  - 1. Screws, bolts, washers, shields, spacers and other similar fastening devices:
    - a. Provide stainless steel vandal resistant screws when outside exterior face glass stops are indicated.
    - b. Furnish and install as required by frame installer.
    - c. Provide Stainless Steel fasteners at Stainless Steel Frames.

## 2.4 FABRICATION

- A. Shop Assembly:
  - 1. General:
    - a. Fabricate in accordance NAAMM-HMMA Standard 810 "Hollow Metal Doors" and NAAMM-HMMA Standard 820 "Hollow Metal Frames," and NAAM-HMMA Standard 850 "Fire-Rated Hollow Metal Doors and Frames."
    - b. Fabricate to the required size and profiles by accurately forming, welding edges straight, sharp and true. Corner bends shall be true and straight and of minimum radius for the gage of metal used.
    - c. All finish work shall be strong, rigid and neat in appearance with corners, hairline joints and surfaces free from warp, wave, buckle, tool marks, surface imperfections or other defects.
    - d. Welding to conform to applicable standards of AWS for high grade finished metal fabrication. All exposed welds shall be ground, filled and dressed smooth with no voids, tool marks, surface imperfections or ridges showing to make them invisible and provide a smooth flush surface.
    - e. Assemblies shall be shop fabricated and permanently assembled before shipment.
      - 1) Where shipping limitations so dictate, frames for large openings shall be fabricated and prepared in section designated for assembly in the field and clearly identified.
  - 2. Metal Door Fabrication:
    - a. General: All doors shall be of the types and sizes required and shall be fully welded seamless construction with smooth surfaces without visible joints of seams on exposed faces or edges.
      - 1) Glazed Lites shall be factory cut openings in doors.

- 2) Provide weep-hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.
- b. Face Sheets: Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door.
- c. Core: Stiffeners shall extending full-door height and spanning the full thickness of the interior space between door faces.
  - 1) Space Stiffeners no more than 6" apart and securely attached to both face sheets by spot welds spaced a maximum of 5" o.c..
  - 2) Solidly pack cavities the entire height of door with mineral-fiber insulation.
    - a) Fire Door Cores: As required to provide fire-protection and temperature-rise ratings as indicated.
- d. Top and Bottom Edges: Closing Channels shall extend the full width of the door at top and bottom edges.
  - 1) All doors shall have recessed Closing Channels, spot welded to both faces. When left exposed, fill all gaps with epoxy sealer and filler, sand smooth with no tool marks or surface imperfections.
  - 2) All doors shall have flush-filler Closing Channels in addition to recessed Closing Channels. Channels shall be continuously welded and ground smooth with no marks at all doors.
    - a) Flush-filler Closing Channel shall be omitted at bottom edge when recess channel is required for hardware.
- e. Jamb Edges: Reinforcing Channels shall extend the full height of the door.
  - 1) Edge profiles shall be provided on both vertical edges of doors as follows:
    - a) Single-Acting Swing Doors beveled 1/8" in 2".
    - b) Double-Acting Swing Doors rounded on 2-1/8" radius.
  - 2) Astragal: Flat x 1-1/2 inch, continuous welded to panel, ground smooth with no tool marks or surface imperfections. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
    - a) Provide overlapping astragal on one leaf of pairs of doors where required for fire-performance rating or where indicated.
    - b) At exterior doors, provide overlapping astragal at strike. Cope astragal around strike plate.
- f. Hardware Reinforcements: Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware contractor.
  - 1) Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only under the face of door.
- g. Glazing Moldings and Stops: Provide glazing moldings and stops to secure glazing material and louvers. Moldings and stops shall be flush with face sheets of door. Use the same trim profile on all Fire-Rated and Non Fire-Rated Openings.
  - 1) Fixed Glazing Moldings shall be securely welded to both face sheets of door.
  - 2) Removable Glazing Stops shall be channel shaped and have mitered hairline corner joints. Drill and dimple stop for countersinking and concealment of fasteners spaces equally at 9" o.c. maximum and a maximum of 2" from ends. Snap-on attachments will not be permitted.
  - 3) Metal surfaces underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a with a rust inhibitive primer prior to installation in the door.

- 4) Coordinate depth and rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
- h. Louvers: Flush opening with all welded construction.
  - 1) Internal channels securely welded to the inside of both face sheets of door.
  - 2) Provide vertical reinforcement at midpoint when louver width exceeds 18" inches.
- 3. Metal Panel Fabrication: Comply with all requirements for Metal Doors.
  - a. Attach securely to frame with concealed anchorage and machine screws.
    - 1) Attachment, including screws, shall be fully concealed when door is closed.
- 4. Metal Frame Fabrication:
  - a. General: All frames shall be welded units of the sizes and profiles indicated and shall be of seamless hollow construction with smooth surfaces without visible joints of seams on exposed faces or edges.
    - 1) Metal Frame Spreaders shall be temporarily attached at bottom of all open frames for shipping and storage.
  - b. Frame Sections: All frames are to be rolled and brake formed with integral nailing flanges, back bends, faces, rabbets, stops, and soffits, unless indicated otherwise.
    - 1) Provide 3 ½ inch wide integral Nailing Flanges at exterior frames. The flange shall be continuous all around the frame at head, jambs and wall sills without gaps at the corner joints. Coordinate flange length with height of concrete curb.
    - 2) Punch and Dimple frames at attachment points for countersinking and concealment of all through the frame anchorage fasteners.
  - c. Frame Joints:
    - 1) Perimeter Corners: Head, Jamb and Wall Sills Members shall be saw-mitered and fully (continuously) welded along entire joint from the throat or the unexposed side at Flanges, Returns, Faces, Rabbet, Stops, and Soffits.
    - 2) Perimeter Butts: Entire joint shall be fully (continuously) welded along entire joint at Flanges, Returns, Faces, Rabbet, Stops, and Soffits from the throat or the unexposed side of the frame.
      - a) Interior Frames: Continuously weld only the Faces. Rabbets, Stops and Soffits shall to be tightly fitted and appear as a hairline seams.
      - b) Vertical Mullions members shall extend through Floor Sill Members to floor. Floor Sill Members Stops are to be notched.
    - 3) Internal Flush and Indented Butts: Vertical Mullions Members shall be continuous, butt to Head and Sill Members and extend through Horizontal Rail Members. Vertical Mullion Stops are to be notched at Head and Sill Members and the Horizontal Rail Stops are to be notched to Vertical Member. Continuously weld only the Faces.
      - a) Exterior Frames: Body Putty continuously along entire joint at returns, rabbets, stops, and soffits creating a water tight joint. Sand flush and smooth with no voids or ridges.
      - b) Interior Frames: Rabbets, Stops and Soffits shall to be tightly fitted and appear as a hairline seams.
  - d. Alignment and Reinforcing Tabs: Provide internal alignment and reinforcing tabs at each joint of field splices with a minimum overlap of 2".
  - e. Internal Frame Stiffeners: Provide additional continuous steel "U" Channel extending the full width of frame and shall be factory welded into head of frame.
    - 1) Grouted Frames with openings greater than 4'-0" width.
    - 2) Frames with openings greater than 12'-0" in width.



- f. Hardware Reinforcements: Frame shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware contractor.
    - 1) Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only under face of frame.
  - g. Grout Guards: Provide at all hardware preparations, tapped mounting holes, glazing stop screws, silencers, and electrical box preparations on frames that are to be grouted.
    - 1) Weld guards to inside of frame at throat.
  - h. Glazing Stops: Provide channel shaped removable Glazing Stops to secure glazing material or panels. Glazing Stops shall be continuous and have butted hairline corner joints.
    - 1) Coordinate stop depth and rabbit width between fixed and removable stops with type of glazing and type of installation indicated.
      - a) Stop Depth 5/8" depth minimum.
    - 2) Drill and Dimple stops for countersinking and concealment of fasteners uniformly spaced at 9 inches o.c. maximum and not more than 2 inches maximum from each corner.
    - 3) Metal surfaces underneath the glazing stops and the inside of the glazing stops shall be treated for maximum paint adhesion and painted with a rust inhibitive primer prior to installation in the door.
5. Frame Anchors:
- a. Coordinate the type of frame anchors with the type of frame insulation or grout being used so that the frame is fully packed with no voids.
  - b. All Frame Anchors shall be securely welded to the throat at inside of frames.
  - c. Frame Anchor Spacing: All Frame Anchors at head, jamb and sill shall be placed a maximum of 8" from frame corners, and ends, with the remainder of the anchors to be equally spaced, not to exceed a maximum of 24" o.c. for all wall types unless indicated otherwise.
    - 1) Masonry Walls: The spacing of anchors shall be equally spaced, not to exceed a maximum of 24" o.c.. Total number of anchors provided on each jamb shall be not less than the following:
      - a) Frames up to 7'-6" height 4 anchors.
      - b) Frames 7'-6" to 8'-0" height 5 anchors.
      - c) Frames over 8'-0" height provide five (5) anchors plus one (1) additional anchor for each 2'-0" or fraction thereof in height over 8'-0".
    - 2) Stud Framed Walls: The spacing of anchors shall be equal spaced, not to exceed a maximum of 18" o.c.. Total number of anchors provided on each jamb shall be not less than the following:
      - a) Frames up to 4'-0" height 4 anchors.
      - b) Frames 4'-0" to 7'-6" high 5 anchors.
      - c) Frames 7'-6" to 8'-0" height 6 anchors.
      - d) Frames over 8'-0" height provide six (6) anchors plus one (1) additional anchor for each 2'-0" or fraction thereof in height over 8'-0".
    - 3) Jamb Base: Provide floor anchors for each jamb and mullion that extends to floor.
      - a) When conditions do not permit the use of a floor anchor, an additional jamb anchor shall be substituted at a location not to exceed 8" from the base of the jamb.

- 4) Floor Base: When conditions do not permit the use of Existing Wall Anchors at floor sill members, provide continuous rough buck for frame anchorage.
- 6. Rubber Door Silencers: Except on weather/sound strip or fire gasket doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
  - a. Single Swing Door Frames Provide and install three (3) at strike jamb.
  - b. Double Swing Door Frames Provide and install four (4) at head.
- B. Fabrication Tolerances:
  - 1. General: Clearances and Tolerances shall be in accordance with NAAMM-HMMA Standard 862 for Exterior Assemblies and NAAMM-HMMA Standard 861 for Interior Assemblies.

## 2.5 FINISHES

- A. Shop Priming:
  - 1. After fabrication, all tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities.
  - 2. Clean and chemically treat (phosphatize) the metal to insure maximum paint adhesion in preparation for primer paint.
  - 3. Apply rust-inhibitive primer paint to all surfaces, minimum dry thickness of 0.7 mils. Manufacturer to provide primer for prolonged exposure that are compatible with substrate and field-applied coatings.
    - a. Coordinate primer used with field-applied paint finishes that are indicated and specified.
    - b. Shop Primer shall not be considered as a substitution for any primer required as part of the field-applied paint finishes.
    - c. Rust-inhibitive primer shall be fully cured before packaging and shipment.
- B. Shop Finishes:
  - 1. Factory-applied Paint Finish:
    - a. Temperature Rise Rated Framing: Apply manufacturer's standard powder coating finish system complying with AAMA [2603][2604][2605].
      - 1) Comply with manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
      - 2) Applied to factory-assembled frames before shipping.
      - 3) Color and Gloss: Color as selected by Architect from Manufacturer's full range of colors.
  - 2. Exposed Metal Finishes:
    - a. Stainless Steel Finish: Comply with NAAMM HMMA 802 Manufacturing of Hollow Metal Doors and Frames "Finishes for Stainless Steel." Refer to NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating stainless steel finishes.
      - 1) Unpolished Finish: No. 2B, bright cold rolled finish.
      - 2) Polished Finishes:
        - a) No. 6 Soft Satin Finish, low reflectivity and produced by Tampico brushing the No. 4 finish using a medium abrasive.

- b) No. 8 Most Reflective Finish, produced by polishing with successively finer abrasive, then budding with a very fine buffing compound until free of grit lines caused by preliminary grinding.
- 3) All grained finishes applied to frames and jambs shall be vertical. Finishes applied to the frame header and sills shall be horizontal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Site Verification of Conditions:

1. Prior to the installation of the work under this specification section, examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work under this specification section.
2. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
3. Report conditions detrimental to performance of the work under this specification section. Proceed with installation only after unsatisfactory conditions have been corrected.
4. Installation of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

#### A. Protection:

1. Protect all adjacent surfaces from damage from work under this specification section.

#### B. Surface preparation:

1. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling and dressing, as required to repair area smooth, flush and invisible on exposed faces.
2. Prior to installation, All frames with temporary spreaders removed, shall be checked for size, and swing, and corrected to installation tolerance for squareness, alignment, twist and plumbness. Securely brace frames and maintain installation tolerances within the following limits.
  - a. Opening Width: Plus 1/16 inch, minus 1/32 inch, measured from rabbet to rabbet at top, middle and bottom of frame.
  - b. Opening Height: Plus 1/16 inch, minus 1/32 inch, measured measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and cross the head.
  - c. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - d. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - e. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines and perpendicular to plane of wall.
  - f. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

#### A. General:

1. Install metal doors and frames plumb, rigid, properly aligned and securely fastened in place; comply with NAAMM-HMMA Standard 840, "Installation and Storage of Hollow Metal Doors and Frames."
2. Install in accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
3. Install Fire-Rated and Smoke-Control Assemblies in accordance with NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and NFPA 105 "Standard for the Installation of Smoke Door Assemblies and Other Openings."

#### B. Frames:

1. Set frames accurately in position, plumbed, aligned, and temporarily braced secure, until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
  - a. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - 1) At exterior frames, Body Putty smooth entire joint continuously along returns, rabbets, stops, and soffits creating a watertight joint. Sand flush with no voids or ridges.
2. Solidly insulate within the throat of all non-grouted exterior and interior frames for the full depth, width and length of frame.
  - a. Provide fire-rated mineral fiber insulation as required to provide fire-protection and temperature-rise ratings as indicated at Fire Rated Assemblies.
  - b. Inject expanding foam insulation as required.
3. Jamb Base: Secure in place frame anchors to floor with post-installed expansion anchors.
4. Floor Base: Secure frames in place with post-installed expansion anchors to floor. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
5. Stud Frame Walls: Secure frames in place with screw fasteners at frame anchors to wall framing.
6. In-Place Stud Frame Walls: Secure frames in place with screw fasteners at frame anchors to wall framing. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
7. Frame and Wall Joints: Provide joint sealants to maintain watertight and airtight continuous seals that aesthetically join dissimilar materials without causing staining or deterioration of joint substrates. Application of sealants shall be in strict compliance with manufacturer's instructions.
  - a. Provide integral color sealants at exterior joints and paintable sealants at interior joints.
  - b. Clean out joint between frames and masonry or concrete to a depth of 3/4 inch. Fill with rod and sealants.

8. Field-apply compatible and paintable sealant at all frame joints that are exposed to the exterior for the full depth of the frame at returns, rabbits, stops and soffits.
- C. Doors: Fit doors accurately in frames, within clearances specified below. Shim as necessary.
  1. Non-Fire-Rated Doors:
    - a. Between door and frame at jambs and head 3/16 inch maximum.
    - b. Between edges of pairs of doors 3/16 inch maximum.
    - c. Door Sill Clearances: Coordinate with threshold conditions and floor materials.
      - 1) Between bottom of door and top of threshold 3/8 inch maximum.
      - 2) Between bottom of door and floor with no threshold 3/4 inch maximum.
  2. Fire-Rated and Smoke-Control Doors: Install doors with clearances according to NFPA 80 "Standard for Fire Doors and Other Opening Protectives" and NFPA 105 "Standard for the Installation of Smoke Door Assemblies and Other Openings."
    - a. Between bottom of door and floor covering surface 1/2 inch maximum.
- D. Glazing Stops:
  1. Coordinate and comply with installation requirements for all glazing indicated and specified.
  2. Secure Glazing Stops to frames and doors with corrosion resistant countersunk flat or oval-head machine screws.
    - a. All exterior screws (head, jamb and sills) shall be attached with a bed of sealant at the penetration point into the frame for a positive seal against water intrusion.
    - b. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners as to be invisible at exposed faces.
  3. All exterior stops shall receive a full bed of sealant at back channel leg for the full length of opening, during final glazing installation for positive seal against water intrusion.
    - a. Coordinate sealants with the requirements of the glazing specified.
    - b.

### 3.4 FIELD QUALITY CONTROL

- A. Site Tests:
  1. As required by Regulatory Requirements.
  2. Mock-Up Assemblies:
    - a. Water Spray Test: Upon completion of the installation of the Mock-Up Assembly, conduct test for water penetration in according to AAMA 501.2 requirements.
      - 1) The Project Inspector, the Architect, Contractor's Superintendent and Sub-contractor's Superintendent shall visually inspect for water penetration.
      - 2) A Thermal Imaging process conducted by a Owner's Testing Laboratory Service, shall be used for additional inspection for water penetration.
      - 3) Cost of additional testing and inspection required due to failure for water tightness shall be borne by the Contractor.
    - b. Reports:
      - 1) Project Inspector and/or Owner's Testing Laboratory Services shall provide a written report noting the installation and water tightness of the Mock-Up Assemblies tested.
- B. Inspection:

1. Notification: Schedule all inspections. Notify the Architect, Project Inspector and any regulatory agencies of the time at least 48 hours prior to the inspection.
2. Regulatory Requirements: No work shall be excepted without the required inspections being performed.

### 3.5 ADJUSTING

- A. Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operation condition. Coordinate with hardware suppliers for function and use.
- B. Remove and replace defective work, including work that is warped, bowed, or other wise unacceptable.

### 3.6 CLEANING

- A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS.
  1. Immediately clean all adjacent surfaces from all foreign materials.
  2. Immediately remove grout, sealants and any foreign materials from bonding to metal doors and frames.
  3. In accordance with manufacturer's instructions and recommendations.
- B. Metal Doors and Frames finishes shall be clean and ready of application of any additional finishes after installation.
  1. Prime-Coat Surfaces: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
  2. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
  3. Stainless Steel Surfaces: Scratched and marred surfaces (including field welding) shall be cleaned and promptly be finished smooth. Refinish to match original finish.

### 3.7 PROTECTION

- A. Protect and maintain conditions that ensures the work is without damage or deterioration until the time of Completion has been executed.
  1. Maintain in a manner acceptable to manufacturer's and installer's warranty.

END OF SECTION

## SECTION 08 31 13 – ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all materials, labor, equipment and services necessary to furnish and install Equipment Access Doors, accessories and other related items necessary to complete Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 08 11 00 METAL DOORS AND FRAMES
  - 4. 09 24 00 CEMENT PLASTER
  - 5. 09 29 00 GYPSUM BOARD
  - 6. 09 30 00 TILE
  - 7. 09 91 00 PAINTING
  - 8. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
    - b. Submit manufacturer's standard color range for selection by the Architect.
  - 2. Shop Drawings.
    - a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Closeout Submittals in accordance with Specification Sections in Division One:
    - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
    - b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
    - c. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
    - d. Warranty in accordance with Specification Section - WARRANTIES.

## 1.3 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    - b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.

2. Manufacturer/Supplier Qualifications:
  - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. In accordance with Specification Section - REGULATORY REQUIREMENTS.
- C. Meetings:
  1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
    - b. Maintaining installed work until the Notice of Substantial Completion has been executed.

#### 1.4 WARRANTY

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period One (1) Year.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Specified product manufacturer:
    - a. MILCOR INCORPORATED, INC.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.



## 2.2 MATERIALS

### A. Access Doors:

1. Design: Equal to Style AP, DW, AT, K or M Access Door as manufactured by MILCOR INCORPORATED, Lima, Ohio.
  - a. Design shall match material conditions present in each specific location.
  - b. In Cement Plaster locations, provide not less than 16 gage frames with a minimum of 24 gage expanded or perforated metal wings designed to finish flush with plaster.
2. Size: Refer to Architectural, Plumbing, Mechanical, and Electrical Drawings.
3. Material: Steel Frame and Door.
4. Operation: Manual
5. Lock: Key operated cylinder lock
6. Finish: Shop Primed, unless otherwise noted.
  - a. In Shower, Toilet, or Locker Rooms all exposed portions shall be brushed stainless steel.
7. Fire Rating: To match wall or ceiling assembly in which doors are located in accordance with Underwriters Laboratories ratings.
  - a. Continuous Hinges shall not obscure rating of doors and frames.

## PART 3 - EXECUTION

### 3.1 PREPARATION

#### A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
2. Coordinate access doors with related items specified under other Sections to ensure proper and adequate interface of work. Particular attention is called to all Plumbing, Mechanical, and Electrical Specifications and drawings and the full cooperation required with that subcontractor's needs and work.

### 3.2 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

END OF SECTION

## SECTION 08 36 13 - SECTIONAL DOORS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes: Provide all material, labor, equipment and services necessary to completely install all Sectional Door materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 30 00 STEEL AND FABRICATIONS
  - 4. 09 90 00 PAINTING
  - 5. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
  - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
  - 2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.
  - 1. Include plans, elevations, sections, and mounting details.
  - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
- A. Coordination Drawings: Include diagrams for power, signal, and control wiring.
- B. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
  - 1. Glazing.
  - 2. Metal for door sections.
  - 3. Hardware.

## 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sectional doors to include in maintenance manuals.

B. Warranty Documentation:

1. Manufacturer's warranty.
2. Finish warranty.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Products shall be individually wrapped.
2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:

1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and Protection Requirements:

1. Products shall be stored in a dry, protected area.

1.6 PROJECT CONDITIONS

A. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

1.7 WARRANTY

A. Contractor's General Warranty: In accordance with Specification Section - WARRANTIES.

B. Manufacturer Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
  - b. Failure of components or operators before reaching required number of operation cycles.
  - c. Faulty operation of hardware.
  - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
  - e. Delamination of exterior or interior facing materials.
  - f. Warranty Period Two years.
- C. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
- 1. Warranty Period: 10 years from date of Substantial Completion.
- D. Installer's Warranty:
- 1. In accordance with the terms of Installer's standard warranty.
    - a. Warranty period One year.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The products listed establish size, pattern, color range and function selected by the Architect for this Project. Acceptable alternatives and substitutions must comply with the requirements of this project. If the acceptable alternatives or substitutions are not approved due to non-compliance with the contract documents, then the Contractor shall submit the specified product.
- B. Source Limitations: Obtain sectional doors from single source from single manufacturer.
  - 1. Obtain operators and controls from sectional door manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

### 2.3 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
  - 1. Specified product manufacturer, or approved equivalent:
    - a. BP COMPANY "California Line"

- A. Operation Cycles: Door components and operators capable of operating for not less than 100,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- B. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.
- C. U-Value: 0.052 Btu/sq. ft. x h x deg F.
- D. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.
  - 1. Door-Section Thickness: 1-3/8 inches.
  - 2. Section Faces:
    - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
    - b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
      - 1) Steel Sheet Thickness: 0.064-inch nominal coated thickness.
      - 2) Surface: Manufacturer's standard, flat.
    - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
      - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.028 inch.
  - 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch Insert dimension nominal coated thickness and welded to door section.
  - 4. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
  - 5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
    - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
    - b. Hardware Locations: Provide reinforcement for hardware attachment.
  - 6. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:

- a. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
  - b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- E. Track: Manufacturer's standard, galvanized-steel, track system configuration shown on drawings. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
  - 1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
  - 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings 2 inches wide.
  - 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
- F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.
- G. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
  - 1. Insulating Glass Units: Refer to Specification Section GLASS.
- H. Locking Device:
  - 1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
  - 2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
    - a. Lock Cylinders: Cylinders complying Section 08 71 00 HARDWARE requirements.
    - b. Keying: Keyed to building keying system.
    - c. Keys: Three for each cylinder.
  - 3. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- I. Counterbalance Mechanism:
  - 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
  - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
    - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.

- b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.
  - 3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
  - 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
  - 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
  - 6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- J. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- 1. Comply with CEC (NFPA 70).
  - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with CEC (NFPA 70), Class 2 control circuit, maximum 24 V ac or dc.
  - 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower.
  - 4. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
  - 5. Operator Type: Manufacturer's standard for door requirements.
  - 6. Motor: Reversible-type with controller (disconnect switch) for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
    - a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor 3 hp.
    - b. Electrical Characteristics:
      - 1) Phase: Refer to drawings.
      - 2) Volts: Refer to drawings.
  - 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
  - 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
    - a. Monitored Entrapment Protection: Photoelectric sensor designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
  - 9. Control Station: Flush mounted, three-position (open, close, and stop) control.

- a. Operation: Key.
  - b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
  - c. Features: Provide the following:
    - 1) Vehicle detection operation.
    - 2) Radio-control operation.
    - 3) Card-reader control.
    - 4) Photocell operation.
    - 5) Door-timer operation.
    - 6) Explosion- and dust-ignition-proof control wiring.
    - 7) Audible and visual signals that comply with regulatory requirements for accessibility.
10. Emergency Manual Operation: Push-up type designed so required force for door operation does not exceed 25 lbf.
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- 1. Factory Prime Steel Finish: Compatible with field-applied finish and in manufacturer's standard color. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
  - 2. High-Performance, Organic, Aluminum Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
    - a. Color and Gloss: As selected by Architect from manufacturer's full range of industry colors and color densities.
- L. Performance Requirements:
- 1. In accordance with allowable values and properties assigned and approved by CBC. It is the intention of this section and the drawings to form a guide for a complete and operable system. Items not specifically noted but necessary for a complete system shall be provided under this section.
- M. Design Requirements:



1. In accordance with allowable values and properties assigned and approved by CBC. It is the intention of this section and the drawings to form a guide for a complete and operable system. Items not specifically noted but necessary for a complete system shall be provided under this section.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Verification of Conditions:

1. Examine substrates, areas, and conditions, with Installers present, for compliance with requirements and other conditions affecting performance of the Work.
2. In the event of discrepancy, immediately notify the Architect. Do not proceed with application in area of discrepancy until all such discrepancies have been fully resolved.
3. Execution of work indicates acceptance of existing conditions.

### 3.2 PREPARATION

#### A. Protection:

1. Protect adjacent surfaces from damage from work under this specification section.

### 3.3 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

#### B. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

#### C. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

#### D. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

- E. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

### 3.4 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
  - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

### 3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

## SECTION 08 41 00 – STOREFRONTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 05 12 00 STEEL AND FABRICATIONS
  - 5. 07 60 00 SHEET METAL
  - 6. 07 92 00 SEALANTS
  - 7. 08 11 00 METAL DOORS AND FRAMES
  - 8. 08 70 00 HARDWARE
  - 9. 08 80 00 GLASS
  - 10. 09 24 00 CEMENT PLASTER
  - 11. 09 29 00 GYPSUM BOARD
  - 12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
    - a. Coordinate Storefront System to receive internal cabling for Facility Service Systems, including but not limited to:
      - 1) Electrical System.
      - 2) Intrusion Detection System.
      - 3) Access Control System.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. AA Aluminum Association
    - b. AAMA American Architectural Manufacturers Association
    - c. ADA Americans with Disabilities Act
    - d. ADAAG Americans with Disabilities Act Accessibility Guidelines – "For Buildings and Facilities".
    - e. ANSI American National Standards Institute
    - f. ASCE American Society of Civil Engineers
    - g. AWS American Welding Society
    - h. BHMA Builders Hardware Manufacturers Association
    - i. GANA Glass Association of North America
    - j. NAAMM National Association of Architectural Metal Manufacturers
    - k. NFRC National Fenestration Rating Council
    - l. SSPC The Society for Protective Coatings (formerly the Steel Structures Painting Council)

## 1.3 DEFINITIONS

- A. Exterior Storefront Systems – indicated on the drawings as SF.

## 1.4 SYSTEM DESCRIPTION

- A. General: Provide aluminum systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
  - 1. Air infiltration and water penetration exceeding specified limits.
  - 2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
- B. Design Requirements: In accordance with allowable values and properties assigned and approved by CBC.
  - 1. Wind Loads: Provide aluminum systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineer's ASCE 7 2016, "Minimum Design Loads for Buildings and Other Structures," Chapter 30 "Wind Loads: Components and Cladding" whichever are more stringent.
    - a. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
- C. Seismic Loads: Provide aluminum systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Chapter 13, Section 13.5.9 "Glass in Glazed Walls, Glazed Storefronts, and Glazed Partitions," whichever are more stringent.
  - 1. Dead Loads: Provide aluminum system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
    - a. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
    - b. Provide a minimum 1/16-inch clearance between members and operable windows and doors.
  - 2. Live Loads: Provide aluminum systems, including anchorage, that accommodate the supporting structure's deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
  - 3. Air Infiltration: Provide aluminum systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 "Test method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen," at a static-air-pressure difference of 1.57 lbf/sq. ft.
  - 4. Water Penetration: Provide aluminum systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 "Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference," at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft.. Water leakage is defined as follows:
    - a. Uncontrolled water infiltrating systems or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

5. Thermal Movements: Provide aluminum systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
  - a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
6. Structural-Support Movement: Provide aluminum systems that accommodate structural movements including, but not limited to, sway and deflection.
7. Condensation Resistance: Provide aluminum systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.
8. Average Thermal Conductance: Provide aluminum systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.1.
9. Dimensional Tolerances: Provide aluminum systems that accommodate dimensional tolerances of building frame and other adjacent construction.
10. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code – Aluminum."

## 1.5 SUBMITTALS

### A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

1. Product Data.
  - a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
  - b. Submit manufacturer's standard color range for selection by the Architect.
2. Shop Drawings.
  - a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
    - 1) For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.
    - 2) Where storefront installed products are indicated to comply with certain design loading, include structural computations, material properties, and other information needed for structural analysis that has been signed and stamped by a registered Civil or Structural Engineer in the State of California.
3. Samples.
  - a. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
  - b. Cutaway Sample: Of each vertical-to-horizontal framing intersection of systems, made from minimum 6-inch lengths of full-size components and showing details of the following:
    - 1) Joinery.
    - 2) Anchorage.
    - 3) Expansion provisions.
    - 4) Glazing.

- 5) Flashing and drainage.
4. Quality Assurance/Control Submittals:
  - a. Test Reports:
    - 1) Submit four (4) copies of reports.
    - 2) Sealant Compatibility and Adhesion Test Reports:
      - a) From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
    - 3) Field Test Reports:
      - a) Indicate and interpret test results for compliance with storefront system's performance requirements.
      - b) Submit the Engineered Transition Assembly Tests from the manufacturer.
      - c) Submit results of the Water Spray Test.
    - 4) Product Test Reports:
      - a) Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.
  - b. Certificates:
    - 1) Submit three (3) copies of certificates.
    - 2) NFRC Certificates for each frame type, by each glass type.
  - c. Manufacturer's Written Instructions:
    - 1) Submit three (3) copies of manufacturer's written instructions.
  - d. Manufacturer's Field Reports:
    - 1) Submit three (3) copies of manufacturer's field reports.
5. Closeout Submittals in accordance with the following:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - c. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
  - d. Warranty in accordance with Specification Section - WARRANTIES.

## 1.6 QUALITY ASSURANCE

- A. Qualifications:
  1. Material Qualifications:
    - a. Obtain each type of aluminum system through one source from a single manufacturer.
    - b. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirement. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
  2. Installer Qualifications:

- a. Engage an experienced installer to assume engineering responsibility and perform work of this section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable of manufacturer.
  - 1) Engineering Responsibility: Prepare data for aluminum systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- b. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- c. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
- 3. Testing Agency Qualifications:
  - a. Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM E 699 "Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components," that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. ADA Americans with Disabilities Act
    - b. ADAAG Americans with Disabilities Act Accessibility Guidelines
- C. Mockups: Before installing aluminum systems, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
  - 1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain Architect's approval of mockups before proceeding with installation of systems.
  - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    - a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## 1.8 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
  2. Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period.
    - a. Warranty Period: 2 years from date of Substantial Completion.
    - b. Failures include, but are not limited to, the following:
      - 1) Structural failures including, but not limited to, excessive deflection.
      - 2) Adhesive sealant failures.
      - 3) Cohesive sealant failures.
      - 4) Failure of system to meet performance requirements.
      - 5) Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      - 6) Failure of operating components to function normally.
      - 7) Water leakage through fixed glazing and frame areas.
  3. Manufacturer's Special Warranty on Door Components: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of door systems that fail at the Door Corners within the specified warranty period.
    - a. Warranty Period: Lifetime on Door Corners.
- C. Installer's Warranty:
1. In accordance with the terms of the Specification Section - WARRANTIES.
  2. Workmanship Warranty:
    - a. Warranty Period: Five (5) years.
    - b. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.
    - c. The subcontractor shall warranty to maintain the entrance and storefront system conditions for the period of years specified from the date of acceptance and shall be responsible for the repair of any failure that is the result of defects in materials and workmanship.
    - d. The subcontractor shall obtain from the manufacturer and the General Contractor a co-endorsement of the Warranty.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project, or approved equivalent. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified product manufacturer:
    - a. KAWNEER COMPANY, INC., utilizing the following products:
      - 1) SF – Storefront System, Exterior: TRI-FAB VG 451T.
      - 2) Entrance Doors 500 TUFFLINE.
    - b. Acceptable alternative manufacturers:



- 1) OLDCASTLE GLASS, allowing the following equivalents to the KAWNEER products listed above:
  - a) SF – Storefront System, Exterior: FG-3000 Thermal Mult-Pane.
  - b) Entrance Doors RuggedLineWS.
2. Accessories:
  - a. Engineered Transition Assembly:
    - 1) TREMCO "Pro Glaze ETA" series.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
  1. Sheet and Plate:
    - a. Per ASTM B 209 "Specification for Aluminum and Aluminum-Alloy Sheet and Plate."
  2. Extruded Bars, Rods, Shapes, and Tubes:
    - a. Per ASTM B 221 "Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes."
  3. Extruded Structural Pipe and Tubes:
    - a. Per ASTM B 429 "Specification for Aluminum-Alloy Extruded Structural Pipe and Tube."
  4. Bars, Rods, and Wire:
    - a. Per ASTM B 211 "Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire."
  5. Welding Rods and Bare Electrodes:
    - a. Per AWS A5.10.
- B. Steel Reinforcement: Complying with ASTM A 36 "Specification for Carbon Structural Steel," for structural shapes, plates, and bars; ASTM A 1008 "Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable," for cold-rolled sheet and strip; or ASTM A 1011 "Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength," for hot-rolled sheet and strip.
- C. Glazing as specified in Specification Section - GLASS.
  1. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended in writing by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended in writing by gasket manufacturer.
  2. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended in writing by manufacturer, compatible with sealants, and suitable for system performance requirements.
- D. Sealant and Joint Fillers for joints at perimeter of aluminum systems as specified in Specification Section – SEALANTS.

1. Sealant: For use as weatherseal, compatible with other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719 "Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)."
  - a. Framing system gaskets, sealants, and joint fillers as recommended in writing by manufacturer for joint type.
- E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

## 2.3 ACCESSORIES

- A. Hardware:
  1. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended in writing by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.
    - a. Continuous Gear Hinges: Manufacturer's standard, continuous, aluminum gear hinges.
    - b. Closers, General: Comply with manufacturer's written recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.
      - 1) Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
      - 2) Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
        - a) Exterior Doors: 5 lbf.
    - c. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1. Provide cover and the following:
      - 1) Mounting: Parallel Arm.
      - 2) Back Check Adjustable.
    - d. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.
    - e. Cylinders: As specified in Specification Section – HARDWARE.
    - f. Rim Cylinders: Manufacturer's standard rim cylinders for installation in exit devices complying with ANSI/BHMA A156.5, Grade 1 requirements.
    - g. Rim-Mounted Exit Devices: Rim-type exit device complying with UL 305 requirements and with one-point latching at door-lock stile that is released by a full-width crash bar or when locked down (dogged) by lock cylinder or retracting screws beneath housing.
    - h. Removable Mullions: See Specification Section – HARDWARE.
    - i. Pull Handles: As selected by Architect from manufacturer's full range of tubular pull handles and plates.
    - j. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
      - 1) Material: Aluminum, mill finish.

- k. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips

B. Engineered Transition Assembly ("Proglaze ETA"):

1. Performance Requirements:

TEST	TEST METHOD	VALUE
Water Vapor Transmission	ASTM E 96	2.59 Perms
Air Infiltration 75 Pa 300 Pa	ASTM E 283	Less than 0.05 L/s/m2 Less than 0.05 L/s/m2
Water Resistance	ASTM E 547 / ASTM E 331	No Leakage
Uniform Load Deflection	ASTM E 330	No Damage
Uniform Load Structural	ASTM E 330	No Damage

2. Pre-Engineered, finished aluminum and silicone materials used as a transition assembly. The system assembly is mechanically attached to the window assembly to assure a durable seal is achieved. The engineered transitions assembly is comprised of the following components:

- "Silicone Rubber Sheet": Extruded, 40 durometer, translucent silicone, with lock-in-dart, 6 inch width.
- "Silicone Rubber Corners": Pre-molded, 40 durometer, translucent silicone, with lock-in-dart, 6 inch width, offset 1.5" to allow lap joint to be made with the Silicone Rubber Extrusion.
- "Extruded Aluminum Adapter": Alodine finished, pre-engineered race for receiving silicone lock-in-dart, supplied in five (5) foot lengths with pre-drilled holes every 6" on center.
- Tape: "440 TAPE": Solid polyisobutylene-cross linked butyl preformed sealant.
- Silicone Sealant: "Spectrem 1": Single-component, neutral-curing silicone sealant, complying with ASTM C 920 "Specification for Elastomeric Joint Sealants."

## 2.4 COMPONENTS

- A. Aluminum Framing: Provide manufacturer's framing compatible with the Manufacturer's Model Numbers specified within the MANUFACTURER's article above. All components shall comply with the Aluminum standards listed under the MATERIALS article above, and wall thicknesses and finish shall comply with Manufacturer's Model Numbers and FINISHES article within this specification section.

1. Construction: **[Thermally broken at exterior locations.][Non-thermally broken at interior locations.]**

B. Aluminum Doors:

- Standard Doors: Provide manufacturer's standard 1-3/4 inch thick glazed doors with minimum 0.1875 inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
  - Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
  - Stile Design: Wide Stile, 5 inch nominal width.

2. Heavy Doors: Provide manufacturer's Heavy-Duty Entrance Doors that are 2 inch thick glazed doors with minimum 3/16 inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
  - a. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
  - b. Stile Design: Wide Stile, 5 inch nominal width.
- C. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide non-staining, nonferrous shims for aligning system components.
- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding, flashing, compatible with adjacent materials, and of type recommended in writing by manufacturer.
- E. Weatherstripping: Manufacturer's standard replaceable weatherstripping as follows:
  1. Compression Weatherstripping: Molded neoprene complying with ASTM D 2000 "Classification System for Rubber Products in Automotive Applications" requirements or molded PVC complying with ASTM D 2287 "Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds" requirements.

## 2.5 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
  1. Fabricate storefront system components for screw-spline frame construction.
  2. Fabricate window wall system and entrance door components for shear-block frame construction.
  3. Fabricate components for head- and sill-receptor frame construction with shear-block construction at intermediate horizontal components.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to GANA's "Glazing Manual."
- G. Glazing Channels: Provide minimum clearances for thickness and type of plastic sheet indicated according to plastic sheet manufacturer's written instructions.
- H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- I. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- J. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
  - 1. Exterior Doors: Provide compression weather stripping at fixed stops.

## 2.6 FINISHES

### A. Aluminum:

- 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- 2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- 3. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- 4. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- 5. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
  - a. Color: **[Light bronze][Medium bronze][Dark bronze][Champagne][Black][Insert color]**.
  - b. Color: **[Match Architect's sample][As selected by Architect from full range of industry colors and color densities]**.
- 6. High-Performance Organic Finish: AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating:
  - a. Fluoropolymer 3-Coat Coating System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
    - 1) Color and Gloss: **[Match Architect's sample][As selected by Architect from full range (Standard, Premium and Custom) of industry colors and color densities]**.
- 7. Powder Coating:
  - a. Solvent-free Architectural Powder Coating, in accordance with AAMA 2604-98, minimum thickness of 1.2 mils, "Interpon D2000," available in 14 standard colors and 17 additional standard matte finish colors as selected by the Architect.
    - 1) Color and Gloss: **[Match Architect's sample][As selected by Architect from full range (Standard, Premium and Custom) of industry colors and color densities]**.
  - b. Finish shall conform to the following:

PERFORMANCE	AAMA 2604 REFERENCE	PERFORMANCE CRITERIA
Dry Film Hardness	Section 7.3	Pass, H
Abrasion Resistance	Section 7.6	Pass, Greater than 20 liters per mil
Wet Adhesion	Section 7.4.1.2	Pass, No film removal or blistering
Humidity Resistance	Section 7.8.1	Pass, No blisters Greater than few No. 8" per ASTM D714
Salt Spray Resistance	Section 7.8.2	Pass, Less than 1.6 mm creep from scribe
Color Retention	Section 7.9.1.2	Color change less than or equal to 5 delta E (Hunter)
Chalking Resistance	Section 7.9.1.3	Pass, No more than No. 8 rating per ASTM D4214
Gloss Retention	Section 7.9.1.4	Pass, Greater than or equal to 30% gloss retention
Erosion Resistance	Section 7.9.1.5	Pass, Less than 10% Film Loss

B. Steel Priming:

1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.
2. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
3. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

2.7 SOURCE QUALITY CONTROL

A. Tests, Inspection:

1. Pre-Construction Sealant Testing: Perform sealant manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by system.
  - a. Test a minimum of 8 samples of each metal, glazing, and other material.
  - b. Prepare samples using techniques and primers required for installed systems.
  - c. Perform tests under environmental conditions that duplicate those under which systems will be installed.
  - d. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

#### A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

#### B. Protection:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
2. Metal Protection:
  - a. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
  - b. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

#### C. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

### 3.3 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
  - a. Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Do not install damaged components.
6. Fit frame joints to produce hairline joints free of burrs and distortion.
7. Rigidly secure non-movement joints.
8. All vertical storefront mullions are continuous; horizontal mullions shall frame into the vertical mullions.
9. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
10. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated.

11. Install Silicone Engineered Transitions in accordance with manufacturer's written instructions.
12. Seal joints weathertight.

B. Layout:

1. Lines shall be straight and true.
  - a. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
  - b. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
    - 1) Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
  - c. Install glazing as follows:
    - 1) Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
      - a) Preparation includes, but is not limited to, cleaning and priming surfaces.
    - 2) Install structural silicone sealant according to sealant manufacturer's written instructions.
    - 3) Mechanically fasten glazing in place until structural sealant is cured.
    - 4) Remove excess sealant from component surfaces before sealant has cured.
    - 5) Install sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints.
      - a) Install joint fillers behind sealant as recommended in writing by sealant manufacturer.
    - 6) Install perimeter sealant to comply with requirements of Specification Section - SEALANTS unless otherwise indicated.

C. Assistance:

1. Application shall be in direct consultation and review of manufacturer's representative.

### 3.4 FIELD QUALITY CONTROL

A. Installation Tolerances:

1. Install aluminum systems to comply with the following maximum tolerances:
  - a. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
  - b. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
  - c. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

B. Site Tests:

1. As required by Regulatory Requirements.
2. Water Spray Test: After completing the installation of test areas indicated (which includes all exterior finishes, glazing, and sealants down to the exterior face of studs, but no cavity insulation or interior finishes), test storefront system for water penetration according to AAMA 501.2 requirements.
  - a. Provide report of the result of all testing.



3. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

C. Inspection:

1. As required by Regulatory Requirements.
2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
3. No work shall be without the inspections required by Regulatory Requirements.
4. Engineered Transition Assembly inspection by a qualified manufacturer's representative of 20 percent of the entire installation shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

### 3.5 ADJUSTING

- A. Adjust doors and hardware to provide tight fit at contact points and weatherstripping, smooth operation, and weathertight closure.

### 3.6 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  1. Clean any soiled surfaces immediately.
  2. Finish shall be clean and ready for the application of any additional finishes.
  3. In accordance with manufacturer's written instructions and recommendations.

### 3.7 PROTECTION

- A. Protection from traffic:
  1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.
  2. Immediately after cleaning, neatly apply four (4) mil thick, minimum, polyethylene film over finished surfaces at traffic areas. Fasten film firmly to surface.

### 3.8 SCHEDULES

- A. The hardware schedule should be used as a guide only. In case of omissions, provide hardware in accordance with that scheduled for a similar opening.

## STOREFRONT HARDWARE SCHEDULE

### MANUFACTURER    INITIALS

ADAMS RITE    AR  
 BEST ACCESSBE  
 GLYNN-JOHNSON    GJ  
 HAFELLE    HAF  
 HAGER    HAG  
 HARDWARE MANUFACTURER    HARD  
 (See Specification Section - HARDWARE)  
 IVES    IV

KAWNEER KAW  
 LCN LCN  
 MARKAR MK  
 NATIONAL GUARD NG  
 NORTON NOR  
 PEMKO PK  
 PRECISION PR  
 REESE RE  
 SARGENT SAR  
 SCHLAGE SC  
 SOUND DOOR AND FRAME MANUFACTURER SDM  
 (See Specification Section SOUND DOORS AND FRAMES)  
 STANLEY ST  
 STOREFRONT MANUFACTURER SM  
 (See Specification Section STOREFRONTS)  
 TRIMCO TR  
 VON DUPRIN VD

GROUP 101 “ (EACH OPENING TO HAVE): SINGLE DOORS, EXTERIOR ALUMINUM EMERGENCY EXIT DOOR, NO DOGGING, NON-RATED.				
QUANT	DESCRIPTION	MANUFACTURER <sup>TMS</sup> NUMBER	FINISH	MANUF.
3 EA	HINGES	KCFM83HD	--	PK
1 EA	EXIT DEVICE	BY HARDWARE MANUFACTURER	--	
1 EA	CLOSER	BY HARDWARE MANUFACTURER	--	
1 EA	KICKPLATE	BY HARDWARE MANUFACTURER	--	
1 EA	DOOR STOP	BY HARDWARE MANUFACTURER	--	
1 EA	DOOR BOTTOM	BY STOREFRONT MANUFACTURER	--	
1 EA	THRESHOLD	SEE DETAILS	--	
1 SET	WEATHERSTRIP	332CS HEAD AND JAMBS	--	PK

END OF SECTION

## SECTION 087000 – HARDWARE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Building Hardware materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 05 12 00 STEEL AND FABRICATIONS
  - 6. 06 41 23 MODULAR CASEWORK
  - 7. 07 92 00 SEALANTS
  - 8. 08 11 00 METAL DOORS AND FRAMES
  - 9. 09 91 00 PAINTING
  - 10. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 11. SPECIFICATION SECTIONS IN THE FACILITY SERVICES GROUP
    - a. Alarm Systems and Power Interface
  - 12. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ADA-S Americans with Disabilities Act 2010 Standards.
    - b. ASAHC American Society of Architectural Hardware Consultants.
    - c. BHMA Builders Hardware Manufacturers Association.
    - d. DHI Door and Hardware Institute.
    - e. HMMA Hollow Metal Manufacturer's Association.
    - f. NFPA National Fire Protection Association.
    - g. UL Underwriter's Laboratories.
    - h. WHI Warnock Hersey Incorporated.

## 1.3 DEFINITIONS

- A. The following definitions apply to this Specification Section:
  - 1. AFF Above Finished Floor.
  - 2. "LABEL" Shall mean "FIRE DOOR ASSEMBLY" as defined in CBC Section 702.
  - 3. LDW Less Door Width.
  - 4. NRP Non Removable Pin.
  - 5. POT Path of Travel (as defined by DSA/ACS and the CBC).

## 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
1. Coordination Drawings:
    - a. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
  2. Product Data.
    - a. Submit manufacturer's technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish (including any custom colors), and other information necessary to show compliance with requirements.
    - b. Provide Key Control System submittal for review prior to fabrication or ordering. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
    - c. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled
  3. Shop Drawings – (Hardware Schedule):
    - a. Submit shop drawings (Hardware Schedule) showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work. Include the following information:
      - 1) Type, style, function, size and finish of each Hardware Item.
      - 2) Name and manufacturer of each item.
      - 3) Fastenings and other pertinent information.
      - 4) Location of each hardware set cross-referenced to indications on the drawings both on the floor plans and in door and frame (opening) schedule as prepared by the Architect.
      - 5) Explanation of all abbreviations, symbols, and codes contained in schedule.
      - 6) Mounting locations for hardware.
      - 7) Door and frame sizes and materials.
      - 8) Keying information.
    - b. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
    - c. Furnish as-built/as-installed schedule with close-out documents, including keying schedule, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information.
  4. Quality Assurance/Control Submittals:
    - a. Certificates:
      - 1) Submit three (3) copies of certificates.
      - 2) Provide a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.

- a) Provide a statement on the certificate that all hardware has been furnished in accordance with the Contract Documents.
  - b) Provide a statement on the certificate that all hardware has been installed correctly and in proper working order.
- 5. Closeout Submittals:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - c. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
  - d. Warranty in accordance with Specification Section - WARRANTIES.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  - 2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
    - b. Firm must be a recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project, and that employs an experienced Architectural Hardware Consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
      - 1) Responsible for detailing, scheduling and ordering of finish hardware.
      - 2) Supplier shall meet with the Owner to finalize keying requirements and to obtain final instructions in writing.
      - 3) Stock parts for products supplied and be capable of repairing and replacing hardware items found defective within warranty periods.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the project is located.
    - b. CBC General Requirements:
      - 1) Adjust closers so that beginning from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum, per CBC Section 11B-404.2.8.1.
      - 2) Where Flush Bolts occur in the POT, they shall be Automatic Flush Bolts (accessible).
      - 3) Lever handles shall return to within 1/2 inch off door face.
      - 4) Hand-activated hardware shall be mounted between 34" to 44" AFF; lever-type hardware, panic bars, push-pull activating and lever for thumb-turn dead bolt hardware shall comply with CBC Section 11B-308 Reach Ranges and 11B-404.2.7 Door and Gate Hardware.

- a) All hand activated hardware shall be easy to operate with one hand, without tight grasping, pinching, or twisting of the wrist to operate; the force required to activate operable parts shall be 5 pounds maximum, per 11B-309.4.
- 5) Force for pushing or pulling doors shall be a maximum of 5 lbs at exterior and interior doors per CBC Section 11B-404.2.9.
- 6) Thresholds in the POT shall be in conformance with CBC Section 11B-404.2.5.
- 7) All rated doors are to be positive latching and self-closing.
- 8) All 20 minute rated assemblies shall be provided with approved gasketing material so installed to provide a seal where the door meets the stop on both sides and across the top.
- 9) Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
  - a) Where emergency exit devices are required on fire-rated doors, (with supplementary marking on door's UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware."
- 10) Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

C. Certificates:

- 1. Provide a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the requirements of this Section.

D. Meetings:

- 1. Pre-installation Conference: Scheduled by the Contractor prior to the start of work.
  - a. Review hardware schedule, products and installation procedures.
  - b. Review Owner's keying standards.
  - c. Coordinate the work with all other related work.
  - d. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
- 2. Progress Meetings: Scheduled by the Contractor during the performance of the work.
  - a. Review proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
- 3. Final Inspection: Scheduled by the Contractor upon proper completion of the work.

- a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
- b. Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  1. Products shall be individually wrapped.
  2. Packaging of door hardware shall be the responsibility of the supplier.
    - a. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule.
      - 1) Two or more identical sets may be packaged in same container.
  3. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted at final inspection.
- B. Acceptance at Site:
  1. Products shall be labeled also with model numbers, catalog numbers, function and finish, identification related to final hardware schedule, and include basic installation instructions with each item or package.
  2. Damaged products will not be accepted.
- C. Storage and protection:
  1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.
  2. Provide secure lock-up for door hardware delivered to the Project, but not yet installed.
    - a. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

## 1.7 WARRANTY

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Closers:
      - 1) Warranty Period Ten (10) Years.
        - a) Exception: Electronic Closers shall be Two (2) Years.
    - b. Exit Devices:
      - 1) Warranty Period Ten (10) Years.
    - c. All other hardware:
      - 1) Warranty Period Ten (10) Years.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES:

- a. Warranty period One (1) Year.

## 1.8 MAINTENANCE

### A. Extra Materials:

- 1. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

- 1. Specified product manufacturer, or approved equivalent:
  - a. Hinges, Butts and Pivots HAGER HINGE CO.
    - 1) Acceptable alternative manufacturers STANLEY HARDWARE.
  - b. Continuous Hinges MARKAR.
    - 1) Acceptable alternative manufacturers PEMKO MANUF. CO.
  - c. Key Control System KEY CONTROL SYSTEMS, INC.
    - 1) Acceptable alternative manufacturers TELKEE INC.
  - d. Cylinders and Locks (Locksets) SCHLAGE LOCK DIV.
    - 1) "D" Series.
    - 2) Acceptable alternative manufacturers FALCON LOCK CO.
      - a) "T" Series.
    - 3) Acceptable alternative manufacturers BEST LOCK CO.
      - a) "9K" Series.
  - e. Bolts IVES.
    - 1) Acceptable alternative manufacturers GLYNN-JOHNSON CORP.
    - 2) Acceptable alternative manufacturers TRIMCO.
  - f. Exit / Panic Devices VON DUPRIN.
    - 1) "98" Series, cylinder dogging, trim ANSI Function 03 #990NL-R.
    - 2) Acceptable alternative manufacturers PRECISION HARDWARE.
      - a) "1100" Series, cylinder dogging, trim ANSI Function 03 #17C.
  - g. Push / Pull Units IVES.
    - 1) Acceptable alternative manufacturers TRIMCO.
  - h. Overhead Closers LCN.
    - 1) Acceptable alternative manufacturers. NORTON DOOR CONTROLS
  - i. Door Control Devices IVES.
    - 1) Acceptable alternative manufacturers GLYNN-JOHNSON CORP.
    - 2) Acceptable alternative manufacturers TRIMCO.
  - j. Door Trim Units IVES.



- 1) Acceptable alternative manufacturers TRIMCO.
- k. Door Stops, General IVES.
- 1) Acceptable alternative manufacturers TRIMCO.
- l. Toilet Room Door Stops McMASTER-CARR CO.
- m. Kick, Mop and Armor Plates IVES.
- 1) Acceptable alternative manufacturers TRIMCO.
- n. Sliding Pocket Door Sets HETTICH INTERNATIONAL.
- 1) Acceptable alternative manufacturers STANLEY HARDWARE.
- o. Door Weatherstripping and Sound / Smoke Seals PEMKO MANUF. CO.
- 1) Acceptable alternative manufacturers NATIONAL GUARD.
- p. Thresholds PEMKO MANUF. CO.
- 1) Acceptable alternative manufacturers NATIONAL GUARD.
- q. Astragals REESE.
- 1) Acceptable alternative manufacturers HAGER HINGE CO.
- r. Adjustable Lightproof Door Kit FULLER & ALBERT, INC.

- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

### A. General:

1. Base Metals: Produce hardware units of basic metal and forming method indicating using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified within this specification section for applicable hardware units for finish designations indicated.
2. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.
3. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
4. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.
  - a. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely.
  - b. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

## 2.3 MANUFACTURED UNITS

### A. Hinges:

1. General:
  - a. Templates: Provide only template-produced units.
  - b. Provide Phillips flat-head screws complying with the following requirements:

- 1) For metal doors and frames, install machine screws into drilled and tapped holes.
  - 2) Finish screw heads shall match surface of hinges or pivots.
2. Butt:
- a. Provide hinge pins as follows:
    - 1) Out-Swing Exterior Doors Nonremovable pins.
    - 2) Out-Swing Corridor Doors with Locks Nonremovable pins.
    - 3) Interior doors Nonrising pins.
    - 4) Tips: Provide flat button and matching plug, finished to match leaves.
  - b. Provide the number of hinges indicated, but not less than the following guidelines:
    - 1) Doors with heights up to 60 inches 2 Hinges.
    - 2) Door with heights 61 to 90 inches 3 Hinges.
    - 3) Doors with heights 91 to 120 inches 4 Hinges.
    - 4) For doors with heights more than 120 inches, provide four hinges, plus one additional hinge for every 30 inches of door height greater than 120 inches.
  - c. Hinges shall be sized in accordance with the following:
    - 1) Height:
      - a) Doors up to 41" wide 4-1/2 inches.
      - b) Doors 42" to 48" wide 5 inches.
    - 2) Width: Sufficient to clear frame and trim when door swings 180 degrees.
3. Pivot:
- a. Pivots shall be high strength forgings and castings with precision bearings for smooth operation. Positive locking vertical adjustment mechanism to allow installer to precisely position the door and balance the load.
4. Continuous:
- a. Continuous hinges shall be UL rated as required.
  - b. Continuous hinges shall not obscure fire-rating labels of doors or door frames.
- B. Lock Cylinders and Keying:
1. Lock Cylinders:
    - a. Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.
  2. Keying:
    - a. Review the keying system with the Owner and provide the type required (Master, grandmaster or great-grandmaster), either new or integrated with the Owner's existing keying system.
      - 1) The Owner's existing Grandmaster System is "Classic" SCHLAGE Keyways:
        - a) [C][CE][E][F].
      - 2) Equip locks with cylinders for construction-core pin tumbler inserts. Provide only temporary inserts for the construction period, and remove these when directed.
        - a) Provide final cores and keys prior to Architect's initial punch list.
    - b. Key Blanks: Provide Standard "6" pin bow key blank; tag to identify.
    - c. Provide keys manufactured from nickel silver only.
    - d. Supply keys and blanks as follows:
      - 1) Supply 2 cut change keys for each different change key code.
      - 2) Supply 1 uncut key blank for each change key code.
      - 3) Supply 6 cut master keys for each different master key set.
      - 4) Supply 4 uncut key blanks for each master key set.

- e. Comply with Owner's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.
    - 1) Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."
  - 3. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of 1/4" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 1992 Grade 1 certified.
- C. Key Control System:
- 1. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended in writing by system manufacturer, with capacity for 150 percent of the number of locks required for the Project.
    - a. Provide hinged-panel type cabinet for wall mounting, or multiple-drawer type cabinet. Coordinate location with the Architect. Provide submittal for review before fabrication or ordering.
- D. Locks, Latches, and Bolts:
- 1. All doors shall be operable from within, without the use of a key by merely rotating the latching handle.
  - 2. All doors in areas used by students shall be self-releasing type, operable from within without the use of a key or special knowledge or effort.
  - 3. Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
  - 4. Lock Protectors:
    - a. Lock astragals shall be provided with internally threaded fasteners for flat head machine screws. No hex head or carriage bolt fasteners will be permitted.
    - b. Must be through bolted to door.
  - 5. Provide 5/8 inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on fire rated fire openings.
    - a. Provide 1/2 inch minimum throw of latch for other bored and preassembled types of locks
    - b. Provide 3/4 inch minimum throw of latch for mortise locks.
    - c. Provide 1 inch minimum throw for all dead bolts.
  - 6. Provide flush bolt heads a minimum of 1/2 inch diameter rods of brass, bronze, or stainless steel with minimum 12 inch long rod for doors up to 7'-0" in height.
    - a. Provide longer rods as necessary for doors exceeding 7'-0" in height.
    - b. Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
    - c. Manual Flush Bolts only permitted on storage or mechanical openings as scheduled.
    - d. Provide dust-proof strikes at openings using bottom bolts.
  - 7. Provide keyed dogging devices on doors equipped with exit devices.
    - a. Do not provide keyed exit devices on fire rated doors equipped with exit devices.
  - 8. Where rabbeted door stiles are indicated, provide special rabbeted front on lock and latch units and bolts.

9. Locksets and Latchsets in Acoustical Doors And Frames require a 3-3/4" backset; verify and coordinate.
  10. All egress doors shall comply with AB 211 (2009-2010).
- E. Exit / Panic Devices:
1. Panic hardware shall comply with CCR Title 24, Part 12, Chapter 12-10-302 (a).
    - a. The release mechanism shall be so designed that a horizontal force of 15 lbs. or less will actuate the release bar and latches applied in the direction of travel.
  2. No surface mounted vertical rods are allowed.
  3. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.
  4. Device shall bear UL label for fire and or panic as may be required.
  5. Removable Mullions:
    - a. Removable with single turn of building key, and securely reinstalled without need for key.
    - b. All removable mullions shall be steel or aluminum clad steel whether or not the opening is fire-rated or not.
  6. No manual Flush Bolts on egress doors.
- F. Push / Pull Units:
1. Provide manufacturer's standard exposed fasteners for installation, thru-bolted for matched pairs but not for single units.
- G. Closers and Door Control Devices:
1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation.
    - a. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory.
    - b. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
  2. Except as otherwise specifically indicated, comply with manufacturer's written recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
    - a. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.
    - b. Effort to operate shall conform to CBC Section 11B-404.2.9 accessibility requirements as follows:
      - 1) Exterior/Interior doors 5.0 pounds maximum.
        - a) The Authority having Jurisdiction may increase the maximum effort to operate Fire Doors to achieve positive latching, but not to exceed 15 lbs maximum.
  3. Where manual closers are indicated for doors required to be accessible, provide adjustable units complying with ANSI A 117.1 and CBC Section 11B-404.2.8 provisions for door opening force and delayed action closing.
  4. Where combination door closers and holders are indicated, provide units designed to hold door in an open position under normal usage and to release and close door automatically under fire conditions.
    - a. Incorporate an integral electromagnetic holder mechanism designed for use with UL listed fire detectors, provided with normally closed switching contacts.

- b. When indicated, provide integral smoke detector device in combination door closers and holders complying with UL 228, Second Edition.
- 5. Provide gray resilient parts for exposed bumpers.
- 6. Closures indicated for use on Acoustical Doors and Frames shall allow for a minimum 1/2" up-down movement due to the Cam-Lift hinges.
- H. Floor Closers:
  - 1. Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.
- I. Kickplates:
  - 1. Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
  - 2. Fabricate edge trim of stainless steel to fit door thickness in standard lengths or to match height of protection plates.
  - 3. Fabricate protection plates not more than 1-1/2 inches less than door width on hinge side and not more than 1/2 inch less than door width on pull side by height indicated.
    - a. Protection plates shall be stainless steel, 0.050 inch (18 gage).
- J. Door Stops:
  - 1. At all Toilet Room Partition Doors, provide stops at adjacent walls or partitions. Stops shall be aligned with the top and bottom of Toilet Partition Doors, and shall be installed on both the Door and the adjacent wall or partition.
    - a. Provide neoprene spring rubber rod, 1-1/2" diameter, as manufactured by McMASTER CARR CO., or approved equivalent. Polish exposed surfaces. Secure with Stainless Steel Fasteners.
  - 2. Coordinate the installation of backing in walls with the door supplier, aligned with the top and bottom of doors.
  - 3. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
  - 4. All Floor Stops shall be installed within four (4) inches maximum from the face of wall, bollard or partition.
  - 5. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- K. Hardware for interior sliding doors:
  - 1. Operating hardware for pocket doors:
    - a. Provide manufacturer's complete set consisting of extruded aluminum or galvanized steel overhead track, adjustable hangers (carriages), galvanized steel split-jambs and split-studs, wood nailers for head track, jambs and studs, galvanized steel brackets for assembly and attachment to floor and wall framing, bumpers, and nylon floor guides designed to accommodate the number (single or biparting), size, thickness, and weight of door leaves indicated.
    - b. Provide flush pull and edge pull for each door leaf.
- L. Seals:
  - 1. Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled.
    - a. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

- b. Provide silicone gasket at all rated and exterior doors, in accordance with ASTM E 283 "Test method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen."
  - 2. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
  - 3. Provide silencers for hollow metal frames, 3 for single doors, 2 for pairs of doors.
    - a. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.
- M. Thresholds:
  - 1. Provide standard metal threshold unit of type, size, and profile as shown or scheduled.
  - 2. Exterior Doors: Provide units not less than 4 inches wide, formed to accommodate change in floor elevation, fabricated to accommodate door hardware and to fit door frames.
- N. Door Shoes & Door Top Caps: Provide galvanized door shoes at all exterior wood doors and galvanized top caps at all exterior out-swing doors.
- O. Fasteners:
  - 1. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
  - 2. Screws for butt hinges shall be flathead, countersunk, full-thread type.
  - 3. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
  - 4. Provide expansion anchors for attaching hardware items to concrete or masonry.
  - 5. All exposed fasteners shall have a phillips head.
  - 6. Finish of exposed screws to match surface finish of hardware or other adjacent work.
  - 7. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

## 2.4 FINISHES

- A. Hardware finishes:
  - 1. General:
    - a. All hardware shall be satin chromium (US26D – 626) unless otherwise noted.
    - b. Provide push plates, pull plates and kick or armor plates in satin stainless steel (US32D – 630) unless otherwise noted.
    - c. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
    - d. Aluminum items shall be finished anodized aluminum (US28 – 628), except thresholds which can be furnished as standard mill finish.
  - 2. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).
  - 3. Provide finishes that match those established by BHMA or, if none established, match Architect's sample.
  - 4. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
  - 5. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."

6. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. Finishes shown by certain manufacturers for their products.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
    - a. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed in writing by the manufacturer.
  2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
    - a. Coordinate electrical power needs for those hardware items requiring electrical interface.
    - b. Coordinate electrical alarm needs (security, fire/smoke detection) for those hardware items requiring electrical alarm interface.
  2. Provide all required hardware templates.
- B. Surface preparation:
  1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  2. Coordinate the blocking required for all wall mounted hardware.
  3. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

### 3.3 INSTALLATION

- A. General:
  1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    - a. Hardware distributor shall assist and advise installer in correcting field problems arising during installation of hardware.
    - b. Hardware distributor shall be on the Project within 48 hours upon being notified by the Contractor.
    - c. Hardware distributor shall assist installer in the proper adjustment of all door closers, and other operating devices.

2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by the Architect.
  - a. Steel Doors and Frames: "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
  - b. Door opening devices shall be installed at 34" minimum to 44" AFF maximum height per CBC Section 11B-404.2.7.
5. Install each hardware item in compliance with the manufacturer's written instructions and recommendations. Where indicated and where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections.
  - a. Do not install surface-mounted items until finishes have been completed on the substrate involved.
6. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
7. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
8. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Specification Section - SEALANTS.
9. Weatherstripping and seals shall comply with manufacturer's written instructions and recommendations to the extent installation requirements are not otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Inspection:
  1. Contractor shall inspect all hardware to assure that it was installed correctly and is in proper working order.
  2. The Contractor shall schedule an inspection prior to substantial completion, and notify the Owner's Inspector and any regulatory agencies of the time 48 hours prior to the inspection.
    - a. The inspection shall cover checking all locks and verifying that they have been installed in accordance with the hardware schedule and the keying schedule.

### 3.5 ADJUSTING

- A. Adjusting:
  1. Adjust and check each operating item of hardware and each door to ensure proper operations or function of every unit.
    - a. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
      - 1) Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area.
      - 2) Clean operating items as necessary to restore proper function and finish of hardware and doors.



- 3) Adjust door control devices to compensate for final operation of heating and ventilating equipment.

### 3.6 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  1. Clean any soiled surfaces immediately.
  2. Finish shall be clean and ready for the application of any additional finishes.

### 3.7 DEMONSTRATION

- A. In accordance with Specification Section - PROJECT CLOSEOUT.
  1. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
    - a. Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
      - 1) Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

### 3.8 SCHEDULES

- A. The hardware schedule should be used as a guide only. In case of omissions, provide hardware in accordance with that scheduled for a similar opening.

## 3.9 HARDWARE SCHEDULE

<b>MANUFACTURER</b>	<b>INITIALS</b>
IVES	IVE
LCN	LCN
PEMKO	PK
PRECISION	PR
SCHLAGE	SC
TRIMCO	TR
ZERO	ZER

## HARDWARE

2175

### HARDWARE GROUP NO. 01 EXTERIOR / STORAGE, EQUIP, CUSTODIAL

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	222APK	A	PEM
1	EA	DOOR CONTACT	3/4" RECESSED NORMALLY CLOSED		
1	EA	THRESHOLD	PER DETAIL		

COORDINATE DOOR CONTACT WITH INTRUSION ALARM CONTRACTOR

### HARDWARE GROUP NO. 02 EXTERIOR RESTROOM – MULTI STALL

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY LOCK	ND75PD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	222APK	A	PEM
1	EA	DOOR CONTACT	3/4" RECESSED NORMALLY CLOSED		
1	EA	THRESHOLD	PER DETAIL		

COORDINATE DOOR CONTACT WITH INTRUSION ALARM CONTRACTOR

### HARDWARE GROUP NO. 03 EXTERIOR OFFICE, TEAM ROOM, SNACKBAR

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND53TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR BOTTOM	222APK	A	PEM
1	EA	DOOR CONTACT	3/4" RECESSED NORMALLY CLOSED		
1	EA	THRESHOLD	PER DETAIL	1	EA

COORDINATE DOOR CONTACT WITH INTRUSION ALARM CONTRACTOR

## HARDWARE GROUP NO. 04 EXTERIOR SGL STALL RESTROOM / W/ "OCCUPIED " INDICATOR

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80T0EU-12V/24DC	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	SURFACE CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
1	EA	MULTI-TECH READER			ZER
1	EA	REQUEST TO EXIT			REX
1	EA	DOOR CONTACT	3/4" RECESSED NORMALLY CLOSED		

COORDINATE DOOR CONTACT WITH INTRUSION ALARM CONTRACTOR

## HARDWARE GROUP NO. 05 INTERIOR TEAM ROOM

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND53TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
3	EA	SILENCER	SR64	GRY	IVE

## HARDWARE GROUP NO. 06 INTERIOR / STORAGE

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
3	EA	SILENCER	SR64	GRY	IVE

## HARDWARE GROUP NO. 07 INTERIOR PASSAGE

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	DOOR STOP	PER DETAIL		
3	EA	SILENCER	SR64	GRY	IVE

**HARDWARE****2175**

## HARDWARE GROUP NO. 08 SITE GATE

2	EA	DEADLATCH	B762	626	SCH
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BALANCE OF HARDWARE BY ORNAMENTAL FENCE CONTRACTOR  
HARDWARE GROUP NO. 09 EXTERIOR SITE DOOR

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY LOCK	ND75PD RHO	626	SCH
1	EA	PRIMUS CORE	20-740	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	DOOR STOP	PER DETAIL		
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

## SECTION 08 80 00 – GLASS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all glass materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 07 92 00 SEALANTS
  - 4. 08 11 00 METAL DOORS AND FRAMES
  - 5. 08 41 00 STOREFRONTS
  - 6. 09 91 00 PAINTING
  - 7. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 8. 10 14 00 IDENTIFYING DEVICES
  - 9. 10 28 13 TOILET ACCESSORIES
  - 10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. AAMA American Architectural Manufacturers Association.
    - b. ANSI American National Standards Institute.
    - c. ASTM American Society for Testing and Materials.
    - d. CSPC Consumer Products Safety Commission.
    - e. FGMA Flat Glass Marketing Association Glazing Manual, 1990 Edition.
    - f. GANA Glass Association of North America
    - g. GTA Glass Tempering Association.
    - h. IGCC Insulating Glass Certification Council.
    - i. LSGA Laminated Safety Glass Association.
    - j. SGCC Safety Glazing Certification Council.
    - k. SIGMA Sealed Insulating Glass Manufacturers Association.

## 1.3 DEFINITIONS

- A. Manufacturer is used in this Section to refer to a firm that produces primary glazing, fabricated glazing, or both as defined in the referenced glazing standards.
  - 1. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed the manufacturing process and not to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass contrary to manufacturers written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass.
  - 2. Glass Surfaces:
    - a. Single Glazed:
      - 1) Surface #1: exposed to outdoors.

- 2) Surface #2: exposed to indoors.
- b. Dual Glazed:
  - 1) Exterior Lite:
    - a) Surface #1: exposed to outdoors.
    - b) Surface #2: faces insulating "air" space. Primary location for energy efficient coatings.
  - 2) Interior Lite:
    - a) Surface #3: faces insulating "air" space. Secondary location for energy efficient coatings.
    - b) Surface #4: exposed to indoors.

#### 1.4 SYSTEM DESCRIPTION

- A. Performance Requirements: It is the intention of this specification and the drawings to form a guide for a completely sealed glazing system. Any items not specifically noted but necessary for a completely sealed glazing system shall be provided under this section.
  - 1. Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure, including loss or glazing breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.
  - 2. Glass Design: Glass thickness indicate minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:
    - a. Minimum glass thickness for lites in exterior walls shall be not less than 6.0mm (1/4" nom.).
  - 3. Thermal Movement: Provide glazing that allows for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on material's actual surface temperatures due to both solar heat gain and nighttime sky heat loss.
    - a. Temperature Change Range: 120 deg F, ambient; 180 deg F, material surfaces..

#### 1.5 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Coordination Drawings:
    - a. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
  - 2. Product Data.
    - a. Submit manufacturer's product data for each glazing product and accessory material indicated.
  - 3. Samples.
    - a. Provide 12 inch square sample of each glass type, color and pattern selected.
    - b. Provide 6 inch square samples of insulated glazing panels for each glazing type and pattern selected.

- c. Provide 12 inch long samples of each type of glazing sealant, gasket or glazing tape. Install sealant or glazing material sample between two strips of material representative in color of the adjoining framing system.
- 4. Quality Assurance/Control Submittals:
  - a. Test Reports:
    - 1) Compatibility and Adhesion Test: From sealant manufacturer indicating that glazing sealants were tested for adhesion to glass and glazing channel substrates and compatibility with glass and other glazing material.
  - b. Certificates:
    - 1) Contractor's Certification.
    - 2) Qualification Data:
      - a) Material Qualifications.
      - b) Installer Qualifications.
      - c) Manufacturer/Supplier Qualifications.
      - d) .
  - c. Manufacturer's Written Instructions:
    - 1) Manufacturer's written installation instructions for all products.
- 5. Closeout Submittals in accordance with the following:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
  - c. Warranty in accordance with Specification Section - WARRANTIES.
    - 1) Special Warranties:
      - a) .
      - b) Insulated Glass Products.
      - c) Insulated Glazing Products.

## 1.6 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:
    - a. Comply with published recommendations of glazing product manufacturers and organizations listed, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
    - b. Obtain glazing from one source for each product indicated.
  - 2. Installer Qualifications:
    - a. An experienced Installer who has completed three (3) projects similar in materials, design and extent to that indicated for this Project; whose work has resulted in glass installation with a record of successful in-service performance..
  - 3. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:



- a. All glazing shall comply with provisions of CBC Chapter 24 for quality standards and CBC Section 2403.1 for identification.
  - b. All glazing subject to Hazardous Locations shall comply with Safety Glazing Requirements and CBC Chapter 2406.
- C. Certificates:
  - 1. Contractor's Certification: Provide a letter on Contractor's Letterhead certifying work provided, meets or exceeds, the Code Minimum requirements, and the other specified requirements of this Section.
  - 2. Qualification Data: Contractor's installation certificates.
  - 3. Product Certificates: Glazing materials manufacturers certifying that their products comply with specified requirements.
- D. Meetings:
  - 1. Pre-Installation: Schedule prior to the start of work.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
    - c. Pre-glazing conference: Scheduled by the Contractor prior to the start of any glazing operation for the proper performance of the work.
      - 1) Minimum agenda shall be to review the work required; discuss field observations, problems, and decisions; corrective measures if necessary; and maintenance of quality and work standards in accordance with manufacturer's warranty requirements.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
    - b. Maintaining installed work until the Notice of Substantial Completion has been executed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
    - a. Protect glazing materials to comply with manufacturer's written directions and as needed to prevent damage to glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
  - 2. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.
- B. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Damaged products will not be accepted.
- C. Storage and Protection:

1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
  - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.8 PROJECT CONDITIONS

### A. Environmental Requirements:

1. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - a. Do not install liquid sealants when ambient and substrate temperature conditions are outside of limits by glazing sealant manufacturer or below 40 deg F.

## 1.9 WARRANTY

### A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

### B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty.
2. Manufacturer's Warranty on Coated Glass Products:
  - a. Submit written warranty signed by coated glass manufacturer agreeing to replace coated glass units that deteriorate as defined in "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
  - b. Warranty Period: Five (5) Years.
    - 1) From date of Substantial Completion.
3. Manufacturer's Warranty on Laminated Glass Products:
  - a. Submit written warranty signed by insulating glass manufacturer agreeing to replace laminated glass units that deteriorate as defined in the "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
  - b. Warranty Period: Five (5) Years.
    - 1) From date of Substantial Completion.
4. Manufacturer's Warranty on Insulating Glass Products:
  - a. Submit written warranty signed by manufacturer of insulating glass agreeing to replace insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
  - b. Warranty Period: Ten (10) Years.
    - 1) From date of Substantial Completion.
5. Manufacturer's Warranty on Acoustical Glass Products:
  - a. Submit written warranty signed by manufacturer of acoustical glass agreeing to replace acoustical glass units that deteriorate as defined in "Definitions" article, f.o.b. the nearest shipping point of Project Site, within specified warranty period.
  - b. Warranty Period: Ten (10) Years.
    - 1) From date of Substantial Completion.
6. Manufacturer's Warranty on Insulated Glazing Panels:
  - a. Submit written warranty signed by manufacturer of Insulating Glazing Panels agreeing to replace Insulating Glazing Panels that deteriorate due to crazing, cracking, color fading and delamination under ordinary conditions.
  - b. Warranty Period: Twenty (20) Years.
    - 1) From date of Substantial Completion.

## C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
  - a. Warranty period One (1) Year.
    - 1) From date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Specified Annealed Float Glass product manufacturer, or approved equivalent:
    - a. Class 1 materials:
      - 1) VITRO ARCHITECTURAL GLASS (formerly PPG INDUSTRIES, INC.).
      - 2) Acceptable Alternative Class 1 Manufacturers:
        - a) AFG INDUSTRIES, INC.
        - b) CARDINAL GLASS INDUSTRIES.
        - c) GUARDIAN INDUSTRIES CORPORATION
        - d) PILKINGTON SALES (NORTH AMERICA) LTD.
    - b.
  2. Specified Glazing Tapes and other Accessory manufacturer, or approved equivalent:
    - a. TREMCO, Glass Tapes "440 Tape".
    - b. Acceptable Alternative Accessory Manufacturer:
      - 1) ADCO "ADCOSEAL GT-1 or GT-4".
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. General:
  1. All glazing shall comply with all provisions of CBC Chapter 24.
    - a. Provide the required strength of glazing to comply with the area limitation set forth in CBC Table 2403.2.1 for individual lites.
  2. Refer to the Glass Schedule of this section for the class of each Glazing Type.
  3. Refer to the Insulating Glazing Panel Schedule of this section for the class of each Insulated Glazing Panel Type.
- B. Annealed Float Glass: ASTM C 1036 "Specification for Flat Glass," Type I, and and ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass," Type (transparent glass, flat), Quality q3 (glazing select), of Class indicated.
- C. Heat-Treated Float Glass: ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass," Type I (transparent glass, flat), Quality q3 (glazing select), of class, kind and condition indicated.

1. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.
  2. Provide Kind HS (Heat-Strengthened) float glass in place of annealed float glass where needed to resist thermal stresses indicated by differential shading of individual glass lites and to comply with glass design requirements.
  3. Uncoated Glass: Comply with the requirements for Condition A.
  4. Coated Glass: Comply with the requirements for Condition C.
  5. Tempered: Provide Kind FT (Fully Tempered) float glass in place of annealed or Kind HS (Heat Strengthened) float glass where safety glass is indicated.
  6. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048 "Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass."
    - a.
- D. Insulated Glass:
1. General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated inter-space, and complying with ASTM E 774 "Specification for the Classification of the Durability of Sealed Insulating Glass Units," of Class CBA units and with requirements specified.
  2. Provide Kind HS (Heat-Strengthened) float glass in place of annealed glass where needed to resist thermal stresses inducted by differential shading of individual glass lites and to comply with glass design requirements.
  3. Tempered: Provide Kind FT (Fully Tempered) glass where safety glass is indicated.
  4. Overall Unit Thickness and Thickness of each lite dimension indicated for insulating glass units are nominal and the overall thickness of units are measured perpendicular from outer surfaces of glass lites at unit's edges.
  5. Sealing System: Dual seal with primary and secondary sealants as follows:
    - a. Manufacturers standard sealants.
  6. Spacer: Manufacturers standard spacer material and construction, compatible with dehydrating gas filler.

## 2.3 ACCESSORIES

- A. Elastomeric Glazing Sealants:
1. General: Provide products of type indicated, complying with the following requirements:
    - a. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glazing products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
    - b. Suitability: Comply with sealant and glazing manufacturer's written recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
    - c. Colors: Provide color of exposed joint sealants to comply with the following:
      - 1) Match colors indicated by reference to manufacturer's standard designations.
      - 2) Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2. Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 "Specification for Elastomeric Joint Sealants," requirements indicated in Specification Section - SEALANTS, including those referencing ASTM classifications for Type, Grade, Class and Uses.

B. Glass Tapes:

1. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended in writing by tape and glazing manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C 1281 "Specification for Preformed Tape Sealants for Glazing Applications," and AAMA 800 "Voluntary Specifications and Test methods for Sealants" for products indicated below:
  - a. AAMA Section 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

C. Miscellaneous Glass Materials:

1. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glass materials involved for glass application indicated, and with a proven record of compatibility with surfaces contacted in installation.
2. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
3. Setting Blocks: Elastomeric material with a Shore Type A durometer hardness of 85 plus or minus 5.
4. Spacers: Elastomeric blocks or continuous extrusions with a Shore Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
5. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).
6. Plastic Foam Joint Fillers: Pre-formed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.
7. Perimeter Insulation for Fire-Resistive Glass: Identical to product used in test assembly to obtain fire-resistive rating.

## 2.4 FABRICATION

- A. Fabricate glass and other glass products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instruction and recommendations of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean cut or flat grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and Polish exposed glass edges and corners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
  - a. Examine glass framing, with glazier present, for compliance with the following:
    - 1) Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
    - 2) Presence and functioning of weep system for aluminum framing systems, and proper sealing of hollow metal frame systems with no weep systems.
    - 3) Minimum required face or edge clearances.
    - 4) Effective sealing between joints of glass-framing members.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
  3. Clean glass channels and other framing members receiving glass immediately before glazing.
  4. Remove coatings that are not firmly bonded to substrates.
  5. Wipe down any mirror backing with alcohol before applying mirror adhesives.

### 3.3 INSTALLATION

- A. Glass, General:
  1. Comply with installation standards of CBC Chapter 24.
    - a. Glass subject to human impact shall be installed in accordance with CBC 2406.
  2. Comply with combined written instructions and recommendations of manufacturers of glass, insulated glass panels, sealants, gaskets, and other glass materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
  3. Glass channel dimensions, as indicated on Drawings, provide necessary bite on glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
  4. Protect glass from edge damage during handling and installation as follows:

- a. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
  - b. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.
  5. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
  6. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
  7. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
  8. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
    - a. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glass tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
    - b. Provide 3.0mm (1/8" nom.) minimum bite of spacers on glass and use thickness equal to sealant width. With glass tape, use thickness slightly less than final compressed thickness of tape.
  9. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
  10. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- B. Tape Glazing:
1. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sight-line of stops.
    - a. Slightly recess tape at exterior conditions, and continuously cap bead with elastomeric sealant leaving no open joints.
  2. Install tapes continuously but not in one continuous length.
    - a. Do not stretch tapes to make them fit opening.
  3. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs.
  4. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.
  5. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped.
  6. Do not remove release paper from tape until just before each lite is installed.
  7. Seal joints in tapes with compatible sealant approved by tape manufacturer.
    - a. Apply continuous heel bead of elastomeric sealant at all exterior hollow metal framing stops.
    - b. Install a continuous toe bead of elastomeric sealant at all exterior hollow metal framing stops on installations with Laminated Glass, Wire Glass or Insulated Glazing Panels.
    - c. Apply continuous cap bead of elastomeric sealant over exposed edge of tape.
  8. Install tapes on all fixed and loose stops.

## C. Sealant glazing (Wet):

1. Install continuous spacers between glass lites and glass stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems (if any) until sealants cure.
  - a. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
2. Force sealant into glass channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
3. Tool exposed surfaces of sealants to provide a substantial wash away from glass.
  - a. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

## 3.4 CLEANING

## A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.

1. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion.
  - a. Wash glass as recommended in writing by glazing manufacturer.

## 3.5 PROTECTION

## A. Protection from traffic:

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.
2. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass.
  - a. Do not apply markers to glass surface.
  - b. Remove nonpermanent labels, and clean surfaces.
3. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter.
  - a. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended in writing by glass manufacturer.
4. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended in writing by glass manufacturer.
5. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

## 3.6 GLASS SCHEDULE

1. **C2-2 Heat Strengthened, Clear Float + Clear Float:**

- |    |                                |                          |
|----|--------------------------------|--------------------------|
| a. | Thickness                      | 25mm (1" nominal).       |
| b. | Insulated Glazing Unit System: |                          |
| 1) | Outdoor Lite:                  | 1/4" HS Clear Float.     |
| a) | Heat Treated, per ASTM C1048   | Kind HS.                 |
| b) | Surface #2 Coating             | SN 54.                   |
| 2) | Interspace:                    | 1/2 Inch.                |
| a) | Spacer Material:               | Manufacturer's standard. |



- b) Content: Air.
  - 3) Indoor Lite: 1/4" HS Clear Float:
  - a) Heat Treated, per ASTM C1048 Kind HS.
- c. Visible Light Transmittance 54.
- d. Solar Heat Gain Coefficient (SHGC) 0.28.
- e. "U" Factor:
  - 1) Winter Night-time 0.29.
  - 2) Summer Daytime 0.27.
- 2. **C2-2T Tempered Clear Float + Clear Float:**
  - a. Thickness 25 mm (1" nominal).
  - b. Insulated Glazing Unit System:
    - 1) Outdoor Lite: 1/4" Clear Float.
      - a) Heat Treated, per ASTM C1048 Kind FT.
      - b) Surface #2 Coating SN 54.
    - 2) Interspace: 1/2 Inch.
      - a) Spacer Material: Manufacturer's standard.
      - b) Content: Air.
    - 3) Indoor Lite: 1/4" Clear Float
      - a) Heat Treated, per ASTM C1048 Kind FT.
  - c. Visible Light Transmittance 54.
  - d. Solar Heat Gain Coefficient (SHGC). 0.28.
  - e. "U" Factor:
    - 1) Winter Night-time 0.29.
    - 2) Summer Daytime 0.27.

END OF SECTION

## SECTION 09 24 00 – CEMENT PLASTER

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Cement Plaster materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS
  - 2. DIVISION 01 SPECIFICATION SECTIONS
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 05 12 00 STEEL AND FABRICATIONS
  - 5. 07 21 00 INSULATION
  - 6. 07 60 00 SHEET METAL
  - 7. 07 92 00 SEALANTS
  - 8. 08 11 00 METAL DOORS AND FRAMES
  - 9. 08 31 13 ACCESS DOORS AND FRAMES
  - 10. 08 41 00 STOREFRONTS
  - 11. 09 30 00 TILE
  - 12. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 13. 09 91 00 PAINTING
  - 14. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 15. 10 14 00 IDENTIFYING DEVICES
  - 16. 10 21 13 TOILET PARTITIONS
  - 17. 10 26 00 WALL AND CORNER GUARDS
  - 18. 10 28 13 TOILET ACCESSORIES
  - 19. 10 44 00 FIRE PROTECTION SPECIALTIES
  - 20. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. AAMA American Architectural Manufacturers Association
    - b. ASTM American Society of Testing Materials
    - c. FS Federal Specification
    - d. ML/SFA Metal Lath / Steel Framing Association - a Division of NAAMM.
    - e. NAAMM National Association of Architectural Metal Manufacturers.
    - f. PDSM Plaster and Drywall Systems Manual, ©1988 by BNI and McGraw-Hill, Inc., Third Edition.
    - g. SSMA Steel Stud Manufacturer's Association.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data:
    - a. Manufacturer's Data for each type of product specified.

- b. Submit manufacturer's standard color range for selection by the Architect.
- c. Manufacturer's full color range (including standard, premium and custom colors) of integral color mixes for selection.
- d. Manufacturer's ICC ES Evaluation Reports (ESR) for fasteners as required.
- 2. Shop Drawings:
  - a. Show location of all metal accessories: expansion joints, control joints, casing beads, corner reinforcements, separation screeds and reglets.
  - b. Provide installation details of flashings at various types of penetrations, all metal accessories, metal lath, and integration with other related work.
- 3. Samples:
  - a. 24 inch square field sample of each Cement Plaster Finish prepared on rigid backing for selection.
    - 1) Cement Plaster Finish of each pattern and texture selected prior to paint coat.
    - 2) Cement Plaster Finish of each pattern and texture for each color with type of paint coating selected. Coordinate with Specification Section – PAINTING.
  - b. 6 inch lineal samples of each piece of specified Metal Accessory material as required for the project.
- 4. Quality Assurance/Control:
  - a. Installer's experience.
  - b. Manufacturer's certification of Installers.
  - c. Manufacturer's installation instructions.
  - d. Water Tightness Test Reports.
  - e. Manufacturer's Field Reports:
    - 1) Confirm mixing and installation procedures of proprietary mixes for all coats of the cement plaster system were within manufacturers requirements.
  - f. Tension Testing Reports.
- 5. Closeout Submittals in accordance with the following:
  - a. In accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Warranty in accordance with Specification Section – WARRANTIES.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:
    - a. Proprietary systems data sheets shall include design properties of each product.
  - 2. Installer Qualifications:
    - a. Installer shall be experienced and shall have successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    - b. Shall participate in a mock-up installation that was successfully tested for water tightness.
    - c. Manufacturer of proprietary products shall provide written certification that the Installer is qualified to install manufacturer's systems in accordance with manufacturer's warranty requirements.
  - 3. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

- B. In accordance with Specification Section – REGULATORY REQUIREMENTS.
- C. Field Samples:
  - 1. Provide Field Samples for approval prior to the application of the cement plaster coats.
  - 2. Field Samples shall be panels of a complete installation, representing each of the finish textures and colors from the approved submittal samples.
    - a. The field samples shall be done by the installers for the project.
    - b. The approved field samples shall establish the acceptable standards for all subsequent work.
  - 3. When it is the Contractor's intent to incorporate the approved sample panels into the finish Project, the panels shall be located in an area relatively obscured from general view.
- D. Mock-Ups:
  - 1. Provide mock-up panels prior to application of cement plaster work and prior to installation of any exterior wall cavity and interior materials.
  - 2. Mock-Up Assemblies:
    - a. Mock-Ups shall be at exterior wall assemblies and shall integrate all other related work assemblies, including but not limited to, each type of wall openings, wall/eave interface, wall sill, parapet cap, various types of penetrations, material transitions and shall be representative of the intended end-use configuration.
      - 1) Mock-Ups shall be a minimum overall size of 10'-0" wide x 8'-0" high.
    - b. Mock Ups will be used for establishing construction sequence, installation requirements of materials, and creating water tight assemblies without the cement plaster coats.
    - c. Mock Ups may become part of the completed Work upon successful testing for water tightness.
  - 3. Installation:
    - a. The Project Inspector, the Architect, Contractor's Superintendent and Sub-contractor's Superintendent shall observe the installation of materials.
    - b. Installation crew for the Mock-Ups shall be the installers of the Cement Plaster Systems for this project and installers, as necessary, of other related work assemblies.
    - c. Mock Ups shall include the installation of water barriers, penetration flashing, Metal Accessories, Metal Lath, and other related work flashings and materials.
    - d. Failed Mock Ups shall be removed and the assembly reinstalled until the water tightness test is successful.
- E. Meetings:
  - 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with all other related work.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.

- b. Maintain installed work until the Notice of Substantial Completion has been executed.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
- B. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Damaged products will not be accepted.
- C. Storage and protection:
  - 1. Store materials inside and under cover on a level platform, six (6) inches above ground, to allow air circulation.
    - a. Keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes.

#### 1.6 PROJECT CONDITIONS

- A. Environmental requirements:
  - 1. Temperature: No plastering shall be done under unsuitable conditions of weather or temperature.
    - a. Exterior: No plastering shall be done when prevailing temperature is 40 degrees F. or less for the preceding 24 hours prior to plastering, during the plaster operations, and for at least 48 hours after the set of each plaster coat.
      - 1) Apply and cure plaster to prevent plaster drying out during the curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
    - b. Interior: Maintain room temperatures at greater than 40 degrees F for at least 48 hours before plaster application, and continuously during and after application.
      - 1) Avoid conditions that result in plaster drying out during curing period. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
      - 2) Ventilate building spaces as required to remove water in excess of that required for hydrating plaster in a manner that prevents drafts of air from contracting surfaces during plaster application and until plaster is dry.
    - c. Factory-Prepared Finishes: Comply with manufacturers written recommendations for the environmental conditions for application of finishes.

#### 1.7 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:

- a. Warranty period One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Water Barriers:
  - a. Building Wrap (also qualifies as an "Air Barrier"):
    - 1) DuPONT COMPANY.
    - 2) TYPAR.
  - b. Sealing Tape:
    - 1) DuPONT COMPANY.
    - 2) Acceptable alternative manufacturers:
      - a) CANTECH INDUSTRIES.
      - b) 3M COMPANY.
      - c) TYPAR.
  - c. Building Paper:
    - 1) FORTIFIBER CORP.
2. Penetration Flashing:
  - a. GRACE CONSTRUCTION PRODUCTS.
  - b. Acceptable alternative manufacturers:
    - 1) FORTIFIBER.
3. Expanded Metal Lath:
  - a. CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
  - b. Acceptable alternative manufacturers:
    - 1) ALABAMA METAL INDUSTRIES CORPORATION (AMICO).
    - 2) CEMCO.
4. Wire Fabric Lath :
  - a. Woven Wire Fabric Lath:
    - 1) GEORGETOWN WIRE COMPANY
    - 2) Acceptable alternative manufacturers:
      - a) DAVIS WIRE COMPANY.
      - b) JAENSON WIRE COMPANY.
  - b. Welded Wire Fabric Lath:
    - 1) STRUCTA WIRE COMPANY, INC.
  - c. .
5. Metal Accessories:
  - a. Galvanized Metal Plaster Accessories:
    - 1) CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
    - 2) STOCKTON PRODUCTS (SP).
    - 3) Acceptable alternative manufacturers:

- a) ALABAMA METAL INDUSTRIES CORPORATION (AMICO).
      - b) CEMCO.
    - b. Aluminum Plaster Accessories:
      - 1) FRY REGLET CORPORATION.
      - 2) Acceptable alternative manufacturers:
        - a) FLANNERY, INC.
        - b) PITTCO.
    - c. Fastener:
      - 1) FLANNERY, INC.
  - 6. Lath Fasteners:
    - a. Screw Anchors:
      - 1) POWERS FASTENERS "TAPPER +".
  - 7. Furring Wads for Screws:
    - 1) FLANNERY TRIM INC. "FURRING WADS".
- B. Products from other manufacturers not listed must submit in accordance with Specification Section – SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Cement Plaster System:
  - 1. Line Wire: Galvanized steel wire, in accordance with ASTM A 641 "Specification for Zinc-Coated (Galvanized) Carbon Steel Wire."
    - a. Minimum 18 gage (0.0475 inch).
  - 2. Water Barriers: Water-Resistive Barriers shall be in accordance with CBC Sections 1404.2 and 2510.6:
    - a. Building Wrap (also qualifies as an "Air Barrier"): Woven and non-woven polyolefin sheets approved per ICC ES Reports for Water-Resistive Barriers for buildings of any construction type and equivalent to Grade D paper with 60 minute water-resistant rating.
      - 1) "Tyvek® Commercial Wrap" by DuPONT COMPANY.
    - b. Sealing Tape (3" wide minimum):
      - 1) "Tyvek® Housewrap Tape" by DUPONT COMPANY.
      - 2) Acceptable alternative manufacturer:
        - a) "Clipper Tape" by CANTECH IND.
        - b) "8086 Construction Sheathing Tape" by 3M.
    - c. Building Paper:
      - 1) Number 15 Asphalt-Saturated felt complying with Type I felt in accordance with ASTM D226 "Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing."
      - 2) Asphalt-Saturated Kraft Waterproof Building Paper approved per ICC ES Reports for Water-Resistive Barriers for buildings of any construction type and equivalent to Grade D paper with 60 minute water-resistant rating.
  - 3. Penetration Flashing: Self-adhered and self-healing weather barrier strips, in accordance with FS UU-B-790a, Grade A.
    - a. 40 mil. minimum thickness, in 9-inch and 12-inch widths as is appropriate for barrier application.
      - 1) "VYCOR V40" by GCP APPLIED TECHNOLOGIES.
      - 2) Acceptable alternative manufacturer:
        - a) "Fort-I-Flash 40" by FORTIFIBER
        - b) "FlexWrap" and "StraightFlash" by TYVEK.

4. Metal Accessories: Zinc Alloy, Aluminum or Hot-Dipped Galvanized Steel, G-60 minimum (Coordinate depth of trim and accessories with the thicknesses and number of plaster coats).
- a. Control Joints:
    - 1) 28 gage galvanized steel, depth as required, AMICO No. "GripLock J Control Joint."
  - b. Casing Bead:
    - 1) 26 gage galvanized steel, 1-1/2" x depth as required, CDBS No. 66, Short Flange Casing Bead.
  - c. Corner Reinforcement:
    - 1) Outside Reinforcements:
      - a) 26 gage galvanized steel, depth as required, CDBS #1A, Expanded Flange.
    - 2) Inside Joints:
      - a) 28 gage galvanized steel, depth as required, CDBS #30 Construction Control Joint.
  - d. Drip Mold:
    - 1) 24 gage galvanized steel, 2-3/4" x depth as required, SP BSS Blind Spot #10 Drip.
  - e. Foundation Sill Screed: 3-1/2 inch minimum vertical attachment flange per CBC Section 2512.1.2.
    - 1) 26 gage galvanized steel, 3-1/2" x depth as required, CDBS #FHA7 Foundation Sill Screed, with weep holes.
  - f. Weep Screed:
    - 1) 26 gage galvanized steel, 1-1/2" x depth as required with weep holes, CDBS #66 Short Flange Casing Bead, with weep holes.
  - g. Single Point Separation Screed:
    - 1) 26 gage galvanized steel, Expanded Metal Base x depth as required, SP PBS Pointed Base Screed with Keyholes.
  - h. Stucco Reglet: 26 gage galvanized steel:
    - 1) 2-1/2-inch flange by FRY REGLET "STX" Series.
    - 2) 1-3/4 inch flange by FRY REGLET "ST" Series.
    - 3) Accessories: Factory manufactured mitered and sealed corners, and polyvinyl chloride "Vinylok" flashing retainer clips.
5. Metal Lath:
- 1) .
  - b. Wire Fabric Lath:
    - 1) Woven: Galvanized steel in accordance with ASTM C 1032, "Specification for Woven Wire Plaster Base," and ASTM C 1066 "Specification for Installation of Lath and Furring to Receive Interior and Exterior Portland Cement-Based Plaster."
      - a) 1-1/2 inch x 17 gage (0.0540 inch) hexagon shaped mesh, 1.86 lbs. per square yard.
      - b) "Paper Backed" Woven Wire Fabric Lath and "Self-Furring" Woven Wire Fabric Lath are not acceptable.
    - 2) Welded: Galvanized steel in accordance with ASTM C 933 "Specification for Welded Wire Lath," and ASTM C 1066 "Specification for Installation of Lath and Furring to Receive Interior and Exterior Portland Cement-Based Plaster."
      - a) 1-1/2 inch x 1-1/2 inch x 17 gage (0.0625 inch) square shaped mesh, 1.14 lbs. per square yard.



- b) "Paper Backed" Welded Wire Fabric Lath is not acceptable.
  - c) "Self-Furring" Welded Wire Fabric Lath without paper backing shall be acceptable.
- 3)  
4)

## 2.3 ACCESSORIES

- A. Fasteners: Shall be in accordance with ASTM C 1063, "Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster".
- 1. Staples: galvanized steel.
    - a. In accordance with ASTM E1667 "Standard Specification for Driven Fasteners, Nails, Spikes and Staples."
    - b. Provide 1/4 inch furring wads at staple attachments for lath.
  - 2. Nails: galvanized steel.
    - a. In accordance with ASTM E1667 "Standard Specification for Driven Fasteners, Nails, Spikes and Staples."
    - b. Minimum, 7/16 inch (0.437 inch) diameter head and 11 gage (0.1205 inch) barbed, roofing or common nails.
    - c. Provide 1/4 inch self-sealing furring wads at nail attachments for lath.
    - d. Tie Nails: 10d galvanized nails.
    - e. Concrete Stub Nails: Corrosion Resistant.
      - 1) Minimum, 3/8 inch wide head.
  - 3. Screws at Wood Framing: Corrosion Resistant.
    - a. In accordance with ASTM C 1002 "Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs."
      - 1) Minimum 7/16 inch (0.437 inch) diameter pan wafer head and a 0.163 inch (#8) diameter shank with sharp-point.
    - b. Provide 1/4 inch furring wads at screw attachments for lath.
    - c.
  - 4.

## 2.4 MIXES

- A. Cement Plaster Mixes: Shall be in accordance with ASTM C 926 "Specification for Application of Portland Cement-Based Plaster."
- 1. Scratch Coat Mix (No additions of plasticizing agents allowed):
    - a. One half part Common Cement.
    - b. One half part Plastic Cement.
    - c. Four parts Sand.
  - 2. Brown Coat Mix (No additions of plasticizing agents allowed):
    - a. One half part Common Cement.
    - b. One half part Plastic Cement.
    - c. Five parts Sand.
  - 3. Finish Coat Mix:
    - a. Exterior Cement Plaster (No additions of plasticizing agents allowed):
      - 1) One part Common Cement.

- 2) One part Miracle Lime.
- 3) Three parts Finish Coat Sand.
  - a) Sieve Size: (20 - 60).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

A. Site verification of conditions:

- 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
- 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
- 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

#### 3.2 PREPARATION

A. Coordination:

- 1. Coordinate work under this specification section with all related work specified under other sections to ensure proper and adequate interface of work.
  - a. Verify and locate framing and or backing necessary for proper installation of cement plaster system.
- 2. Integrate Water barriers and Penetration Flashing with all flashings from all other related work for proper shedding of water out of the building.
- 3. Protection:
- 4. Project Inspector shall verify that all stud cavity walls are free of moisture and dry prior to any other construction that fully closes the wall cavity.
- 5. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
  - a. Provide temporary protections and enclosures for other work.

B. Surface preparation:

- 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
- 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

#### 3.3 INSTALLATION

A. General:

- 1. It is the intent to provide a weather resistant exterior plaster system envelope upon completion.
  - a. Overlap and shingle fashion all substrate barriers, papers and penetration flashing with accessories in such a way as to shed water at the midpoint flashing (i.e. floor juncture flashing, or head flashing at openings and penetrations), or allow it to weep to drainage weep holes at the foundation sill screed in accordance with the requirements of the CBC Section 1403 and 1404.2.

2. In accordance with ASTM C 1063, "Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster" and ASTM C 926, "Application of Portland Cement-Based Plaster."
  - a. In accordance with CBC Chapter 7, Chapter 7A, Chapter 14, and Chapter 25.
  - b. In accordance with listed UL Assemblies at designated fire rated assemblies.
  - c. In accordance with "The Plaster and Drywall Systems Manual" (PDSM).
  - d. In accordance with Regulatory Requirements.
- B. Layout:
  - a. Set plumb, level, and square.
  - b. Lines of all Metal Accessories shall be straight and true. Set accessories to create a cement plaster finish plane within a tolerance of 1/8 inch in 10 feet.
  - c. Apply all Brown and Finish Coats of plaster to create a finish plane with a tolerance of 1/8 inch in 10 feet.
- C. Installation of Line Wire:
  1. Apply Line Wire prior to the placement of the water barriers.
  2. Line Wire shall be installed at open framing of exterior vertical assembly.
  3. Install Line Wire perpendicular to the framing members at 6" on center and secured to every fourth framing member with a screw.
    - a. Stretch Line Wire sufficiently tight to minimize bulging of the Water Barriers and to ensure a uniform thick scratch coat.
- D. Installation of Water Barriers:
  1. Install Water Barriers after installation of Line Wire at open framing.
  2. Water barriers shall be installed at all exterior walls, exterior soffits, and at interior walls considered to be "Semi-Wet" and "Wet" exposures (i.e. Toilets, Showers, Lockers, Kitchens and etc.).
  3. Install Water Barriers with Penetration Flashing, Metal Accessories, and all other related work in "shingle" or "weatherboard" fashion.
  4. Water Barriers shall be installed as required in CBC Sections 1404.2, 1404.3, 1405, and 2510.6 as follows:
    - a. Provide two layers of Water Barriers.
      - 1) One inner layer of Building Wrap (also qualifies as an "Air Barrier"):
        - a) Seal all laps and penetrations with a 3" wide minimum Sealing Tape.
      - 2) One outer layer of Building Paper.
    - b. The Water Barrier shall be applied horizontally, with the upper layer lapped over the lower layer not less than 6 inches and free from holes and breaks.
      - 1) Where vertical joints occur, barrier shall be lapped not less than 6 inches.
    - c. Exposure:
      - 1) Maximum exposure of Water Barriers shall be 30 days prior to plaster application or less as required by Water Barrier Manufacturer.
        - a) Protect Water Barriers from the elements (both exposure to the sun and water) with a temporary 6-mil visqueen barrier or other material approved by the barrier manufacturer.
- E. Installation of Penetration Flashing:
  1. Apply Penetration Flashing in conjunction with Water Barriers, Metal Accessories and all other related work.

2. Install Penetration Flashing at all openings and penetrations at all exterior walls and at interior walls considered to be "Semi-Wet" and "Wet" exposures (i.e. Toilets, Showers, Lockers, Kitchens, etc.).
  3. Install Penetration Flashings with Water Barriers, Metal Accessories and all other related work in "shingle" or "weatherboard" fashion.
  4. Penetration Flashings shall be installed in accordance with CBC in 9" widths and continuous to 9" past all intersections around all openings, penetrations and termination of plaster systems.
    - a. Should any penetration warrant a greater width of wall flashing, provide 12" wide flashing as required.
    - b. When an object extends through the Cement Plaster System, return the edge of the Penetration Flashing 1" and apply to the sides of the penetrating item.
  5. Objects such as electrical back-boxes, electrical speaker enclosures, penetrations created by structural members, and the like.
- F. Installation of Metal Accessories:
1. Apply Metal Accessories in conjunction with Water Barriers, Penetration Flashings and all other related work.
  2. Install Metal Accessories as required to delineate cement plaster work into areas of the following maximum size and shall be in addition to locations shown on the drawings:
    - a. Vertical surfaces 144 sq.ft.
    - b. Horizontal and other non-vertical surfaces 100 sq.ft.
    - c. Length-to-width ratios of not greater than 2-1/2:1.
    - d. Distances not greater than 18 feet.
  3. Install Metal Accessories with Water Barriers, Penetration Flashing Sheets and all other related work in "shingle" or "weatherboard" fashion.
  4. Install all Metal Accessories in accordance with manufacturer's instructions, and the PDSM.
    - a. All Metal Accessories shall be fully supported in accordance with CBC, secure flanges to framing.
    - b. Installed in 10 foot lengths wherever possible.
    - c. When an object extends through the Cement Plaster System, accurately cut and install in "shingle" or "weatherboard" fashion the Metal Accessories around the penetration. Apply sealant between the metal accessories and the penetrating object.
  5. Metal Accessories shall be attached to framing members along supports.
    - a. **[[6 inches o.c. w/ rigid insulation].**
    - b. Single Point Separation Screeds can be wire tied over Metal Lath.
    - c. Where dissimilar metals come into surface contact provide electrolytic protection between dissimilar metals using neoprene, plastic sheet, EPDM rubber or other protective coating.
- G. Installation of Metal Lath:
1. General:
    - a. Apply Metal Lath after the installation of Line Wire, Water Barriers, Penetration Flashings and Metal Accessories.
    - b. Install the various types of Metal Lath at the following conditions:
      - 1) Diamond Mesh Lath at horizontal and vertical surfaces over open framing members at 16 inches on center.

- 2) .
- 3) Woven Wire Fabric Lath over Solid Sheathing.
- 4) Welded Wire Fabric Lath over Solid Sheathing.
- 5)
- c. Apply Metal Lath in accordance with all applicable portions of CBC Chapters 7 and 25, and ASTM C 1063 "Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster."
  - 1) Metal Lath shall be applied with long dimension of sheet perpendicular to the framing members to which it is attached.
    - a) All fasteners shall be corrosion resistant equal to or superior to that of the lath.
    - b) All lath shall be furred out away from supports and solid substrate at least 1/4 inch.
    - c) Lath shall be attached to framing members along framing members except for 3/8-in. rib metal lath shall be attached at each rib [**at no more than 7 inches o.c. w/o rigid insulation**][**at no more than 6 inches o.c. w/ rigid insulation**].
  - 2) The Metal Lath shall be broken at all metal accessories and cut into panels that are defined by the edges of the cement plaster metal accessories, expansion joints and the like.
    - a) Perimeter of the lath panel shall be wire tied to the cement plaster metal accessories.
    - b) No joints shall be permitted at any angle or corner.
  - 3) Lapping of Metal Lath.
    - a) Side laps shall be secured to framing members and shall be wire tied between supports with No. 18 gage (0.0475-inch) galvanized annealed steel wire at 9" o.c. maximum.
    - b) Where end laps occur between the framing members or between attachments, the end of the metal lath sheets shall be laced or wire tied with No. 18 gage (0.0475 inch) galvanized annealed steel wire.
    - c) Expanded Metal Lath shall be lapped 1/2-inch or nest the edge ribs at sides and 1" at ends.
    - d) Wire Fabric Lath shall be lapped one mesh at the sides and the ends.
- 2. Wood Frame Construction:
  - a. Horizontal Framing:
    - 1) Screws shall be in accordance with the methods of attachment set forth in CBC Table No. 2507.2 per CBC Section 2507.3.
    - 2) Either of the following attachments shall be used in addition to the methods of attachment set forth in CBC Table No. 2507.2 per CBC Section 2507.3:
      - a) Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage (0.475 inch) galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches above the bottom of the joist and the ends of the wire secured together with three twists of the wire.

- b) Secure lath to each support with 1/2 inch wide, 1-1/2 inch long No. 9 W & M gage (0.1483 inch), ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches from edge of each sheet. Such staples may be placed over ribs of 3/8 inch rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.
  - b. Vertical Framing:
    - 1) Wire staples driven flush with plaster base, crown not less than 3/4 inch, shall provide not less than 3/4 inch penetration into framing members when lath is installed and shall engage not less than three strands of lath.
    - 2) Common nails or roofing nails driven to penetration of not less than 3/4 inch into framing members when lath is installed and shall be bent over to engage not less than three strands of lath.
      - a) Nail attachments at Hi-Rib Lath shall be bent over ribs.
    - 3) Screws shall penetrate not less than 5/8 inch into framing members when lath is installed and shall engage not less than three strands of lath.
      - a) Screw attachments at Hi-Rib Lath shall pass through, but not deform rib.
      - b)
  - 3. Wire tie laps and metal accessories with expanded metal flanges. Screw anchor fasten accessories with solid flanges.
  - 4. Attach accessories in such a manner as to ensure proper alignment during plaster application.
    - 1)
- H. Cement Plaster Installation:
  - 1. General: Each plaster coat shall be applied without interruption to entire wall or ceiling panels to eliminate cold joints and abrupt changes in the uniform appearance of succeeding coats. Panels are defined by naturally occurring interruptions in the plane of the plaster, such as corner angles, rustications, openings, and control joints.
  - 2. Nominal Cement Plaster Thickness over Metal Lath:
    - a. At open framing and sheathing substrates, Vertical and Horizontal Surfaces: 7/8" nominal.
      - 1) Scratch Coat thickness: 3/8".
      - 2) Brown Coat thickness: 3/8".
      - 3) Finish Coat thickness: 1/8".
    - b. .
  - 3. Scratch Coat Installation:
    - a. Cover Lath totally and completely with Scratch Coat Mix.
    - b. Finish: Heavily scratched at right angles to framing members to provide strong mechanical key for Brown Coat.
    - c. Curing: Continuously moist cure a minimum of 48 hours immediately after installation and prior to application of Brown Coat.
  - 4. Bond Coat Installation:
    - a. Apply "Surface Applied Liquid Bonding Agent" Mix solid over masonry or concrete and fill all pores completely to form bonding, water resistant finish.
    - b. Cure: In accordance with Manufacturer's requirements and ASTM C 932 "Specification for Surface-Applied Bonding Compounds for Exterior Plastering."
  - 5. Brown Coat Installation:
    - a. Apply Brown Coat Mix to slightly damp, and cured Scratch Coat.

- b. Finish: Dry rod to a straight even plane.
- c. Float to densify at 1/8 inch in 10 feet and leave rough for finish.
  - 1) At exterior horizontal soffits with recessed light fixtures, provide a smooth and level brown coat finish around the perimeter of the light fixture housing.
    - a) After installation of the brown coat, knock down any ridges and provide a smooth trowel finish within a distance of 3 inches around the light fixture housing. This level of finish is required, so that the light fixture lens (with a compression gasket) can be installed with full contact against the plaster system.
    - b) Coordinate with the electrical contractor and obtain a sample fixture lens, and conduct a pre-cement plaster installation meeting to discuss this topic.
- d. Curing: Continuously moist cure a minimum of 48 hours immediately after installation and dry cure a minimum of 7 days, allow time for plaster to shrink prior to application of finish coats.
- 6. Finish Coat Installation:
  - a. Exterior Cement System:
    - 1) Provide Open Corner Reinforcement where cement plaster is not divided or separated at opening corners. Place diagonally at all corners of openings and apply with cement adhesive on cured Brown Coat.
    - 2) Apply 2 coats of Finish Coat Mix.
      - a) First coat 1/16 inch minimum. Completely cover to create a bond with Brown Coat.
      - b) Second coat 1/16 inch minimum. Apply immediately after first coat and when first coat is dry using a plaster mix of thinner consistency. Apply to create depth for texture and uniformity.
      - c) Use proportionately more atomizing air at the gun nozzle.
    - 3) Texture: "Light Dash" finish as indicated in the current "Plaster and Drywall Systems Manual."
      - a) Texture to be "Medium Dash" finish when application of paint finish coats to be an "Elastomeric" Paint System.
    - 4) Curing: Continuously moist cure a minimum of 48 hours immediately after installation and dry cure a minimum of 7 days to allow time for plaster to shrink prior to installation of paint finish coats.

### 3.4 REPAIR / RESTORATION

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

### 3.5 FIELD QUALITY CONTROL

- A. General: Comply with ASTM C 926 "Standard Specification for Application of Portland Cement-Based Plaster."
  - 1. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed on surface.
  - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Site Tests:
  1. As required by Regulatory Requirements.
  2. Mock-Up Assemblies:
    - a. Water Spray Test: Upon completion of the installation of the Mock-Up Assembly, conduct test for water penetration in according to AAMA 501.2 requirements.
      - 1) The Project Inspector, the Architect, Contractor's Superintendent and Sub-contractor's Superintendent shall visually inspect for water penetration.
      - 2) A Thermal Imaging process conducted by the Owner's Testing Laboratory Service, shall be used for additional inspection for water penetration.
      - 3) Cost of additional testing and inspection required due to failure for water tightness shall be borne by the Contractor.
    - b. Reports:
      - 1) Project Inspector and/or Owner's Testing Laboratory Services shall provide a written report noting the installation and water tightness of the Mock-Up Assemblies tested.
- C. Inspection:
  1. As required by Regulatory Requirements and in accordance with CBC Section 2503.
  2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.
  3. No work shall be without the inspections required by Regulatory Requirements.

### 3.6 CLEANING

- A. Clean in accordance with Specification Section – PROJECT CLOSEOUT.
  1. Clean any soiled surfaces immediately.
  2. Finish shall be clean and ready for the application of any additional finishes.
  3. In accordance with manufacturer's written instructions and recommendations.
- B. Remove temporary protection and enclosure of other work.
- C. Promptly remove plaster from door frames, window and other surfaces not indicated to be plastered.
- D. Repair floors, walls and other surfaces stained, marred or other wise damaged during plastering

END OF SECTION



## SECTION 09 29 00 – GYPSUM BOARD

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all gypsum board materials, suspension systems, furring, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 06 41 23 MODULAR CASEWORK
  - 4. 07 21 00 INSULATION
  - 5. 07 92 00 SEALANTS
  - 6. 08 11 00 METAL DOORS AND FRAMES
  - 7. 08 31 13 ACCESS DOORS AND FRAMES
  - 8. 08 41 00 STOREFRONT
  - 9. 09 30 00 TILE
  - 10. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 11. 09 68 40 CARPET
  - 12. 09 72 00 WALL COVERINGS
  - 13. 09 91 00 PAINTING
  - 14. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 15. 10 11 00 VISUAL DISPLAY BOARDS
  - 16. 10 14 00 IDENTIFYING DEVICES
  - 17. 10 21 13 TOILET PARTITIONS
  - 18. 10 26 00 WALL AND CORNER GUARDS
  - 19. 10 28 13 TOILET ACCESSORIES
  - 20. 10 44 00 FIRE PROTECTION SPECIALTIES
  - 21. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. CISCA Ceilings & Interior Systems Construction Association.
    - b. DITF Drywall Industry Trust Fund.
    - c. GA Gypsum Association.
    - d. MPI Master Painters Institute
    - e. PDCA Painting and Decorating Contractors of America.
    - f. PDSM Plaster and Drywall Systems Manual, ©1988 by BNI and McGraw-Hill, Inc., Third Edition.

### 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Gypsum board fastening schedule: Indicate type, size and spacing of fasteners for each type of framing and fire resistive condition.
    - b. Manufacturer's written recommended construction instructions or handbook for all gypsum board panel products and accessories.
    - c. Manufacturer's written recommended construction instructions or handbook for all suspension system products and accessories
    - d. Manufacturer's data for all types of gypsum board used on this project.
  - 2. Samples.
    - a. Provide 24 inch square samples for all textures for each level of finish.
    - b. Provide 4 inch lineal samples of each piece of metal trim accessory specified.
  - 3. Quality Assurance/Control Submittals:
    - a. Test Reports:
      - 1) Site Tests of suspended gypsum board ceiling fasteners and anchors provided by Testing Agency.
    - b. Certificates:
      - 1) General Construction: Certificate signed by the Contractor on Contractor's letterhead.
      - 2) Products: Certificates signed by manufacturers of gypsum board assembly components.
  - 4. Closeout Submittals in accordance with Specification Section -PROJECT DOCUMENTS.
    - a. Warranty in accordance with Specification Section - WARRANTIES.

### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:
    - a. Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 "Test methods for Fire Tests of Building Construction and Materials," by an independent testing and inspecting agency acceptable to CSFM.
    - b. Empty containers shall not be removed from site without the Project Inspector's approval.
  - 2. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
      - 1) Helpers and apprentices used for such work shall be under full and constant supervision at all times by thoroughly skilled gypsum board installers.
      - 2) In the acceptance or rejection of installed gypsum board, no allowance will be made for lack of skill on the part of installers.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. IR Interpretation of Regulations.
- C. Certificates:

1. General Construction: Contractor to certify that work provided, meets or exceeds the requirements of this section.
2. Manufacturers of gypsum board assembly components certify that their products comply with specified requirements.
  - a. Certify that all adhesive and compound materials have a good shelf life longer than the construction period of this project.

D. Mockups:

1. Before starting the finishing of gypsum board surfaces, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
  - a. Install mockups for the following applications:
    - 1) All surfaces without finish texture.
    - 2) All surfaces without finish texture to be painted.
    - 3) All surfaces with finish texture to be painted.
  - b. Simulate finished lighting conditions for review of mockups.
  - c. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Meetings:

1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
  - b. Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

B. Acceptance at Site:

1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
2. Damaged products will not be accepted.

C. Storage and protection:

1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
  - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.6 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified gypsum board products manufacturer:
    - a. NATIONAL GYPSUM COMPANY.
      - 1) Wallboard "REGULAR"
      - 2) Moisture-Resistant "XP GYPSUM BOARD"
      - 3) Sheathing "eXP SHEATHING"
      - 4) Soffit "EXTERIOR SOFFIT BOARD"
    - b. Acceptable alternative manufacturers:
      - 1) PABCO:
        - a) Wallboard "REGULAR" AND "TYPE X"
        - b) Moisture-Resistant "MOLD CURB PLUS"
        - c) Sheathing "GLASS SHEATHING"
        - d) Soffit "EXTERIOR SOFFIT"
      - 2) UNITED STATES GYPSUM COMPANY - "SHEETROCK"
        - a) Wallboard "SW EDGE"
        - b) Moisture-Resistant: "MOLD TOUGH"
        - c) Sheathing "SECUROCK GLASS-MAT SHEATHING"
        - d) Soffit "EXTERIOR GYPSUM CEILING BOARD"
  - 2. Specified Roof Board board products manufacturer:
    - a. G-P GYPSUM "DENS-DECK"
    - b. Acceptable alternative manufacturers
      - 1) UNITED STATES GYPSUM COMPANY
        - a) SECUROCK Roof Cover Board.
  - 3. Specified gypsum board accessories product manufacturer:
    - a. Prep. Coat (Drywall Primer):
      - 1) WESTPAC MATERIALS "PREP COAT"
      - 2) Acceptable alternative manufacturer:

- a) UNITED STATES GYPSUM - SECUROCK First Coat Primer.
  - b. Primer-Surfacers: "TUFF-HIDE"
    - 1) UNITED STATES GYPSUM COMPANY.
  - c. Other Accessories:
    - 1) CLARK DIETRICH BUILDING SYSTEMS, LLC (CDBS).
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Furring:
  - 1. Metal Angles: 24 gage galvanized steel.
    - a. 1-3/8 inch x 7/8 inch 190 lbs./1000 feet weight.
  - 2. Cold Rolled Channels: 16 gage galvanized steel.
    - a. For furred walls and ceilings:
      - 1) 3/4 inch x 1/2 inch flange: 300 lbs./1000 feet weight.
      - 2) 1-1/2 inch x 17/32 inch flange: 500 lbs./foot weight.
      - 3) 2 inch x 17/32 inch flange: 590 lbs./1000 feet weight.
  - 3. Resilient Channels (USG's RC-1): 25 gage corrosion resistant steel.
    - a. Pre-punched holes at 4 inches on center in the flange to facilitate screw attachment only into framing. For improving sound transmission loss through framed partitions and ceilings.
      - 1) 1/2 inch flange x 2-1/2 inch overall w/1-1/2 inch offset flange x 1/2 inch offset:
        - a) 200 lbs./1000 feet weight.
  - 4. Zee Channels: 24 gage corrosion resistant steel.
    - a. 1 inch thick x 7/8 inch x 1-1/4 inch 224 lbs./1000 feet weight.
    - b. 1-1/2 inch x 7/8 inch x 1-1/4 inch 269 lbs./1000 feet weight.
    - c. 2 inch x 7/8 inch x 1-1/4 inch 313 lbs./1000 feet weight.
    - d. 3 inch x 7/8 inch x 1-1/4 inch 400 lbs./1000 feet weight.
  - 5. Hat Channels:
    - a. 7/8 inch x 2-9/16 inch 276 lbs./1000 feet weight (25 gage).
    - b. 7/8 inch x 2-9/16 inch 515 lbs./1000 feet weight (20 gage).
- B. Wallboard: For interior walls and ceilings.
  - 1. Standard: In accordance with ASTM C 1396 "Standard Specification for Gypsum Board."
  - 2. Size: See drawings for specific thickness locations.
    - a. 5/8 inch thick by 4 foot wide maximum by practical length to minimize joints.
  - 3. Long Edges: SW Tapered.
  - 4. Core Type:
    - a. Non-Fire Rated: Regular.
    - b. Fire Rated: Type X at fire-resistive-rated assemblies.
  - 5. Finish: Natural-finish face paper suitable for paint, wallpaper or other decorations.
- C. Moisture-Resistant: For interior walls subjected to intermittent moisture and humidity and at adhesive application of ceramic tile and wallcoverings.
  - 1. Standard: In accordance with ASTM C 1396 "Standard Specification for Gypsum Board."

- a. Surface Burning Characteristics: ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
    - 1) Flame Spread: 20.
    - 2) Smoke Developed: 0.
  - b. Mold/Mildew Characteristics:
    - 1) Mold Resistance: ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi": 0.
    - 2) Mold Resistance: ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber": 10.
    - 3) Water Absorption: ASTM C 173 "Test method for Air Content of Freshly Mixed Concrete by the Volumetric Method": less than 5 percent.
  - 2. Size - see drawings for specific thickness locations:
    - a. 5/8 inch thick by 4 foot wide maximum by practical length to minimize joints.
  - 3. Long Edges: Tapered.
  - 4. Core Type:
    - a. Non-Fire Rated: Regular moisture-resistant core.
    - b. Fire Rated: Type X and moisture-resistant additives, at fire-resistive-rated assemblies.
  - 5. Finish: Multi-layered paper facings, chemically treated to resist moisture penetration.
- D. Sheathing/Soffit: For exterior walls and soffits.
- 1. Standard: ASTM C 1177 "Standard Specification for Glass-Mat Gypsum Substrate for use as Sheathing."
    - a. Surface Burning Characteristics per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
      - 1) Flame Spread: 20.
      - 2) Smoke Developed: 0.
  - 2. Long Edges: Square.
  - 3. Type and Thickness: [Regular, 1/2 inch] thick.
  - 4. Facing: fiberglass mat laminated to both sides.
- E. Roof Board:
- 1. Thickness 5/8 inch.
  - 2. Surfacing: Glass Mat.
  - 3. Flute Spanibility:
    - a. 5/8 inch thick: 8 inches per ASTM E 661 "Test Method for Performance of Wood and Wood-Based Floor and Roof Sheathing Under Concentrated Static and Impact Loads."
  - 4. "R" Value:
    - a. 5/8 inch thick: 0.67 per ASTM C 518 "Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus."
  - 5. Water Absorption: 10.0
    - a. Per ASTM C 473 "Test methods for Physical Testing of Gypsum Panels and Products."
  - 6. Compression Strength: 500-900 psi normal.
  - 7. Surface Water Absorption: 2.5 grams.
    - a. Nominal per ASTM C 473 "Test methods for Physical Testing of Gypsum Panels and Products."

8. Flame Spread / Smoke Developed Index: 0/0.
  - a. Per ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials."
9. Mold Resistance: No Growth.
  - a. Per ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber."

F. Metal Accessories:

1. Corner Beads:
  - a. Outside Corner, 1-1/4 inch x 1-1/4 inch galvanized:
    - 1) CDBS / USG "Dur-A-Bead" #103.
2. Edge Trim:
  - a. "U"-Shaped 1 inch galvanized CDBS / USG #200-A, size to fit gypsum board.
  - b. "L"-Shaped 1 inch galvanized CDBS / USG #200-B, size to fit gypsum board.
    - 1) When "U"-Shaped molding above cannot be used.
3. Control Joint:
  - a. 1-3/4" wide, 1/4" wide center channel with removable tape strip:
    - 1) CDBS / USG #093.

## 2.3 ACCESSORIES

A. Water:

1. Clean, fresh and free from deleterious amounts of foreign material.

B. Fasteners:

1. At Gypsum Board: In accordance with the manufacturer's written recommendations and the following:
  - a. Nails: In accordance with CBC Chapter 7 and ASTM C 514 "Standard Specification for Nails for the Application of Gypsum Board."
  - b. Screws: In accordance with CBC Chapter 7, ASTM C 1002 "Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs," type S, G, and W, and ASTM C 954 "Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness," Type S-12.
    - 1) Provide "Bugle Head" screws that help prevent damage to the gypsum core and face paper.
  - c. Adhesives: In accordance with ASTM C 475 "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board."
    - 1) Commercial adhesives bridging minor irregularities in the base or framing at "non-fire-rated" construction.
      - a) In accordance with ASTM C 557 "Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing."

C. Joint reinforcement tape and joint compounds:

1. In accordance with ASTM C 474 "Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction" and C 475 "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board," and Gypsum Board Manufacturer's written recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
  - a. Joint Tapes:
    - 1) Paper reinforcing tape, unless otherwise indicated.
    - 2) Polymer-coated, open glass-fiber mesh for cementitious backer units.

- b. Setting-Type Joint compounds for gypsum board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
  - 1) When used for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
  - 2) When used for pre-filling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.
  - 3) When used for filling joints and treating fasteners of moisture-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.
  - 4) When used for topping compound, use sandable formulation.
- D. Prep. Coat: Provide a preparation coat of the specified material to gypsum board surfaces to be decorated with all paints.
- E. Primer-Surfer: "TUFF-HIDE" by USG, Interior White Latex High Build Spray for a smoother paint finish over all types of drywall, 9.8 to 13 mils DFT in one spray application
- F. Textured Finish Coats: Gypsum Board manufacturer supplying the products to this project shall also supply the Texture Finishes to provide distinctive appearance and surface decoration to gypsum board panel walls and ceilings, and as scheduled at the end of this Specification Section.
- G. Other Materials: All other miscellaneous materials, not specifically described, but required for a complete and proper installation of gypsum board, shall be as selected by the Contractor subject to the approval of the Architect.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

#### 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
  - 2. Coordinate proper placement of ceiling mounted tracks, accessories, light fixtures, HVAC, registers and other items, which are to be integrated with gypsum board ceilings.
- B. Protection:
  - 1. Do not begin work until all rooms have been protected against the weather, and the building is covered and fully enclosed. Wet gypsum board after installation shall be removed and replaced at no extra cost to the Owner.
  - 2. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.



- C. Surface preparation:
1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

### 3.3 INSTALLATION

- A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
  2. In accordance with Regulatory Requirements.
    - a. DSA's IR 25-3 "Suspended Gypsum Board Ceiling."
  3. Set plumb, level, and square.
- B. Layout:
1. Lines shall be straight and true.
  2. Control Joints:
    - a. Layout in accordance with GA-234-08 for both Non-Rated and Rated wall and ceiling conditions as follows:
      - 1) Provide Control Joints at in an uninterrupted straight plane exceeding 30 ft. in length and total area between control joints, such that no area exceeds 900 sq.ft.
- C. Furring Channels:
1. Attach hat channels at 16" o.c. to framing members at 24" o.c. maximum with one 1-1/2" Type "G" screw at each bearing point. Stagger screws to opposite sides at every bearing surface.
- D. Gypsum Board:
1. General:
    - a. During Winter Weather Installation periods, follow the GA-220 GYPSUM BOARD WINTER RELATED INSTALLATION RECOMMENDATIONS.
  2. Install in accordance with CBC Chapter 25, DITF and GA recommendations, gypsum board panel manufacturer's written recommendations and in accordance with fire-rated design numbers.
    - a. At Ceilings and Soffits:
      - 1) At gypsum board ceilings and soffit areas, install the ceiling prior to installing the walls.
      - 2) Float the interior ceiling angles, and where permitted by code,
    - b. At Sound and Acoustical Walls:
      - 1) Set all gypsum board panels on each side of the partition in a continuous 1/4 inch bead of acoustical sealant furnished and installed in accordance with the provisions of Specification Section -- SEALANTS.
    - c. At Moisture Resistant Walls:
      - 1) Install where scheduled and in all areas where high moisture conditions are present, or ceramic tile, or wall coverings are scheduled over gypsum board.
      - 2) In all areas to be tiled, treat all edges, cutouts, utility holes and joints, corners and nailheads with an approved sealant material in lieu of standard taping. Joints not to be covered by tile shall be treated as regular gypsum board. Do not use standard joint compound under ceramic tile.
    - d. At Sheathing:

- 1) Screw-attach sheathing to exterior of each stud with 1" Type "S-12" corrosion resistant screws spaced 3/8" from ends and edges and approximately 8" o.c. Apply sealant around sheathing perimeter at interface with other materials and install flashing.
  3. Install gypsum board panels horizontally on walls, floor to ceiling.
  4. At metal frames terminate wall board panel edge inside frame. Do not terminate gypsum board panel edge against metal frame trim unless otherwise indicated.
- E. Cutting:
1. Cut gypsum board panels by scoring and breaking or by sawing, working from the face side.
    - a. When cutting by scoring, cut through the face paper and then snap the panel back away from the cut face; then break the backpaper by snapping the panel in the reverse direction or by cutting the back paper.
  2. Smooth all cut ends and edges of panels as necessary to obtain a smooth joint.
  3. For cut-outs in panels for pipes, fixtures, and other small openings, make holes and cut-outs by sawing or by such other method as will not fracture the core or tear the covering and with such accuracy that plates, escutcheons, or trim will cover the edges.
  4. The use of "score-and-knockout" method will not be permitted.
- F. Metal Accessories:
1. Corner Beads:
    - a. Install at all corners with galvanized screws at nine (9) inch intervals in both flanges with fasteners placed opposite one another the full length of the corner bead. Clinch-on fastening is not allowed.
      - 1) Fasteners shall be driven below the anticipated finished joint compound surface.
    - b. Install in one piece except when length of corner exceeds stock lengths – then put splice up high away from people traffic.
  2. Edge Trim: Install at all exposed joints where gypsum board panels abut another material with galvanized screws at nine (9) inch intervals the full length of the edge trim. Clinch-on fastening is not allowed.
    - a. Fasteners shall be driven below the anticipated finished joint compound surface.
    - b. Provide joint sealer in accordance with Specification Section -- SEALANTS.
      - 1) Provide fire sealant in accordance with Specification Section -- FIRSTOPPING or Specification Section -- SEALANTS, when the wall or ceiling is part of a fire-rated situation.
  3. Control Joints:
    - a. Install at 30'-0" o.c. maximum at all interior walls or partitions with uninterrupted planes that exceed 30' in length.
      - 1) Opening frames that are full height of wall or partition may be considered a control joint.
    - b. Install at 50'-0" o.c. maximum at all interior ceilings and shall not exceed 2,500 sq.ft. in total area with perimeter relief.
    - c. Install at 30'-0" o.c. maximum at all interior ceilings and shall not exceed 900 sq.ft. in total area without perimeter relief.
- G. Fastening:
1. Properly space all fasteners in careful accordance with the manufacturer's written recommendations and code requirements, with heads driven slightly below the surface for proper cementing, but without breaking the paper face.

2. Loosely butt all joints to be taped; firmly butt all joints to be left untreated.
  3. Stagger all end joints and the joints between panels to achieve a maximum of bridging and a minimum of continued joints.
- H. Taping and Finishing:
1. First Coat:
    - a. Spread compound evenly over all joints, using suitable tools designed for the purpose.
    - b. Fill all joint recesses and metal trim.
    - c. Center the reinforcing tape on the joint and press into the fresh compound at all joints, wiping down with sufficient pressure to remove excess compound but leaving sufficient compound under the tape for proper bond.
    - d. Feather all edges and leave the surface free from blisters and tape wrinkles.
    - e. Apply compound to all fastener recesses, leaving flush with the adjacent surfaces.
    - f. Fold reinforcing tape along its centerline and apply to all interior angles, following the same procedure as for joints.
    - g. Surfaces shall be free of excess joint compound.
  2. Second Coat:
    - a. Lightly sand the dry compound with fine sandpaper to remove all irregularities.
    - b. Apply a second coat of compound to all joints, feathering approximately three inches beyond edges of tape.
    - c. Apply second coat to all fastener recesses.
    - d. Surfaces shall be free of excess joint compound.
  3. Third Coat:
    - a. Lightly sand the dry compound with fine sandpaper to remove irregularities.
    - b. Apply final skim coat, feathering out approximately two inches beyond second coat.
    - c. Third coat all fastener recesses and metal trim, and all interior angles; allow to dry.
    - d. Surfaces shall be free of excess joint compound.
- I. Prep. Coat (Drywall Primer):
1. Apply Prep. Coat material at approximately 200 sq.ft. per gallon for all painted wall surfaces. Follow manufacturer's written recommendations for proper preparation of material, mixing and installation at recommended minimum coverage rates.
    - a. For smooth walls with no texture, provide airless sprayer application in accordance with manufacturer's written recommendations.
      - 1) Fine finish: Sand wall surface with 220 grit mesh screen after application of Prep. Coat. **Do not oversand!**
    - b. For textured walls: Provide roller application with a 3/8" to 1/2" nap roller before texture application is applied in accordance with manufacturer's written recommendations.
- J. Primer - Surfacer:
1. Apply Primer - Surfacer material at manufacturer's written recommendations for proper preparation of material, mixing and installation, and at recommended minimum coverage rates.
    - a. For smooth walls with no texture, provide airless sprayer application in accordance with manufacturer's written recommendations.
      - 1) Fine finish: Sand wall surface with 220 grit mesh screen after application of Primer - Surfacer. **Do not oversand!**

- b. For textured walls: Provide roller application with a 3/8" to 1/2" nap roller before texture application is applied in accordance with manufacturer's written recommendations.
- K. Textured Finish Coats: After taping and finishing, apply Textured Finish Coats as indicated in the schedule at the end of this Specification Section.

### 3.4 FIELD QUALITY CONTROL

#### A. Marking and Identification:

- 1. Where there is an accessible concealed floor, floor-ceiling or attic space, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space and shall comply with all of the following:
  - a. Be located in accessible concealed floor, floor/ceiling, or attic spaces.
  - b. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
  - c. Include lettering not less than 3 inches in height with a minimum 3/8 inch stroke in a contrasting color identifying the wall type and its fire-resistance rating.
    - 1) "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.

#### B. Site Tests:

- 1. Testing Agency: The Owner's Testing Laboratory Agency shall perform field tests and Inspections and prepare test reports.
  - a. Testing and inspecting of completed installations of suspended gypsum board ceiling fasteners and anchors shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with installations of gypsum board ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
- 2. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed:
  - a. Concrete Anchors:
    - 1) Must be capable of sustaining, without failure, a load equal to 200 lbs. tension for hanger wires and 440 lbs. tension for bracing wires by construction as determined by testing according to ASTM E 488 "Test Methods for Strength of Anchors in Concrete and Masonry Elements," by a qualified independent testing agency.
      - a) Hanger Wire Anchors 1 in 10 must be field tested.
      - b) Bracing Wire Anchors 1 in 2 must be field tested.
- 3. Remove and replace gypsum board ceiling hangers where test results indicate that they do not comply with specified requirements.
- 4. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  - a. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors or previously tested until 20 pass consecutively and then will resume initial testing frequency.

#### C. Inspection:

- 1. As required by Regulatory Requirements.
- 2. Schedule inspections and notify the Architect, Project Inspector and any other regulatory agencies of the time at least 48 hours prior to the inspection.

3. No work shall be without the inspections required by Regulatory Requirements.

### 3.5 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  1. Clean any soiled surfaces immediately.
  2. Clean any soiled surfaces at the end of each day, minimum.
  3. Finish shall be clean and ready for the application of any additional finishes.
  4. In accordance with manufacturer's written instructions and recommendations.

### 3.6 PROTECTION

- A. Protection from weather:
  1. Protect newly installed work from moisture after installation.
- B. Protection from traffic:
  1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

### 3.7 SCHEDULES

- A. The following textured finish coat finishes shall be applied to the board surfaces within the scope of this section prior to covering with other finish materials.
  1. Refer to the Material and Finish Schedule for specific locations of each substrate finish.
  2. Where no specific substrate finish is called for on the drawings, select the appropriate level of substrate finish from the descriptions below for the final finish material.
  3. Where no determination can be made from the descriptions below, provide a minimum of GB-2 substrate finish.
  4. Where sound, smoke control or fire-ratings are required, details of construction shall be in accordance with reports of tested assemblies meeting the requirements.
- B. GB-2 - Architect's Finish Designation:
  1. Level 4 - GYPSUM ASSOCIATION'S LEVEL OF GYPSUM BOARD FINISH:
    - a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound surfaces shall be smooth and free of tool marks and ridges.
    - b. Architect's Finish:
      - 1) Uniformly smooth and ready to receive light textures ("Spray-Splatter," "Orange Peel" (light or heavy) "Stipple" or "Skip Trowel" finishes), or medium grade wall-coverings.
      - 2) Use "Orange Peel" light texture finish when walls and ceilings are scheduled to be painted, unless otherwise noted.
- C. GB-3 - Architect's Finish Designation:
  1. Level 2 - GYPSUM ASSOCIATION'S LEVEL OF GYPSUM BOARD FINISH:

- a. All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
- b. Architect's Finish:
  - 1) Total surface must be sufficiently smooth to create a good bonding plane acceptable for installation of scheduled materials (ceramic tile, plywood, acoustical tile or similar materials).

END OF SECTION

## SECTION 09 30 00 - TILE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all tile materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 07 18 50 VAPOR-ALKALINITY CONTROL
  - 5. 07 92 00 SEALANTS
  - 6. 08 31 13 ACCESS DOORS AND FRAMES
  - 7. 09 24 00 CEMENT PLASTER
  - 8. 09 29 00 GYPSUM BOARD
  - 9. 09 68 40 CARPET
  - 10. 10 21 13 TOILET PARTITIONS
  - 11. 10 28 13 TOILET ACCESSORIES
  - 12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. ADAAG Americans with Disabilities Act Accessibilities Guidelines
    - b. ADAS Americans with Disabilities Act Standards
    - c. ANSI American National Standards Institute, Specifications for the Installation of Ceramic Tile, latest edition, unless otherwise indicated.
    - d. FDA Food and Drug Administration
    - e. TCNA Tile Council of North America "Handbook for Ceramic Tile Installation"

## 1.3 DEFINITIONS

- A. Definitions shall comply with the latest edition of the TCNA "Handbook for Ceramic Tile Installation."
  - 1. MOH's: Relative Measure of Hardness by scratching the surface of the tile with different minerals and subjectively assigning a "MOH's Scale Hardness" number to the glaze.

## 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data:
    - a. For each type of Tile indicated.
    - b. Manufacturer's full color range (including any standard and premium colors).

- c. Design Data for components, fillers, adhesives, etc.
- 2. Shop Drawings:
  - a. Location of all movement/expansion joints.
- 3. Samples:
  - a. 12 inch square sample of each color and pattern selected.
  - b. 6 inch lineal samples of each piece of trim material specified.
- 4. Quality Assurance/Control Submittals:
  - a. Test Reports:
    - 1) From Manufacturer that all floor tile complies with the slip resistance standards recommended by the ADAAG/ADAS.
  - b. Certificates:
    - 1) Provide TCNA Master Grade Certificate.
  - c. Manufacturer's Written Installation Instructions.
  - d. Statement of Installer's Qualifications.
- 5. Closeout Submittals in accordance with the following:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Warranty in accordance with this specification, and with Specification Section - WARRANTIES.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:
    - a. Tile Grade: Standard Grade in accordance with ANSI A 137.1x.
    - b. Tile shall meet the Breaking Strength limits listed in accordance with ASTM C 648 "Test Method for Breaking Strength of Ceramic Tile."
    - c. Tile shall meet the Scratch Hardness limits in accordance with MOH's
    - d. TCNA Master Grade Certificate signed by tile manufacturer and tile installer.
  - 2. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- B. In accordance with Specification Section - REGULATORY REQUIREMENTS.
  - a. CBC California Building Code (CBC 804.1)
- C. Meetings:
  - 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
    - c. Review delivery, storage, and handling procedures.
    - d. Review Project Conditions.
    - e. Review subfloor preparation procedures.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.



- b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
- a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
  - b. Maintain installed work until the Notice of Substantial Completion has been executed.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be handled in such a manner as to assure that they are free from dents, chips, scratches and other damage.
- B. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Damaged products will not be accepted.
- C. Storage and protection:
  - 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

#### 1.7 PROJECT CONDITIONS

- A. Environmental requirements:
  - 1. Temperature:
    - a. Maintain temperature in space to receive ceramic tile above 50 degrees F for 3 days prior, during, and 7 days following installation.
- B. Existing Conditions:
  - 1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  - 2. Field Measurements:
    - a. Take and be responsible for field measurements as required.
    - b. Report any significant differences between field dimensions and drawings to the Architect.

#### 1.8 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty,

2. Warranty Period shall be for the following:

- a. Interior Ceramic Tile      One (1) Year.
- b. Exterior Ceramic Tile      One (1) Year.
- c.

C. Installer's Warranty:

- 1. In accordance with the terms of the Specification Section - WARRANTIES:
  - a. Warranty period: One (1) Year.

1.9 MAINTENANCE

A. Extra Materials:

- 1. Maintenance Material:
  - a. In accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Supply 2 square feet of tile and 3 lineal feet of trim for each color and pattern of tile

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

- 1. Interior Ceramic Tile manufacturer:
  - a. DALTILE.
  - b. Acceptable alternative manufacturers:
    - 1) CROSSVILLE CERAMICS.
    - 2) INTERCERAMIC.
- 2. Exterior Accent Ceramic Tile manufacturer:
  - a. BUCHTAL.
  - b. Acceptable alternative manufacturers:
    - 1) DALTILE.
- 3. Grout Materials manufacturer:
  - a. MAPEI.
  - b. Acceptable alternative manufacturers:
    - 1) CUSTOM BUILDING PRODUCTS, INC.
    - 2) LATICRETE.
- 4. Mortar Materials manufacturer:
  - a. MAPEI.
  - b. Acceptable alternative manufacturers:
    - 1) CUSTOM BUILDING PRODUCTS, INC.
    - 2) LATICRETE.

5. Admixture manufacturer:
    - a. MAPEI "Plancrete AC."
  6. Metal Trim manufacturer:
    - a. SCHLUTER SYSTEMS.
  7. Membranes manufacturer:
    - a. THE NOBLE COMPANY.
    - b. Acceptable alternative manufacturers:
      - 1) DALTILE.
      - 2) INTERCERAMIC.
  8. Sealer manufacturer:
    - a. CUSTOM BUILDING PRODUCTS Tile Lab "Surface Gard Penetrating Sealer"
      - 1) Acceptable alternative manufacturers:
        - a) C-CURE "Penetrating Sealer #978"
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. General:
1. Slip Resistance:
    - a. Level Surfaces:
      - 1) Static Coefficient of Friction (SCOF): Tile installed on level walkway surfaces shall be slip resistant by achieving a minimum 0.6 or greater static coefficient of friction as recommended in Appendix A4.5 of the ADAAG by testing per ASTM C 1028 "Test method for Static Coefficient of Friction of Ceramic Tile and Like Surfaces by the Horizontal Dynamometer Pull Meter Method."
      - 2) Dynamic Coefficient of Friction (DCOF): Tile installed on level walkway surfaces shall be slip resistant by achieving a minimum 0.42 or greater dynamic coefficient of friction as recommended in ADAS per TCNA technical bulletin "Coefficient of Friction and the DCOF AcuTest," by testing per ANSI A 137.1 "American National Standard Specifications for Ceramic Tile," section 9.6 "Procedure for Dynamic Coefficient of Friction (DCOF) Testing."
  2. Colors and patterns shall be selected from manufacturer's standard line (including premium), except as noted otherwise.
- B. Ceramic:
1. Interior Cove Base Tile **CTB-1**.
    - a. Manufacturer: DALTILE.
      - 1) "Chord" colorbody porcelain
    - b. Design: 6" high x 12" long coved base, including inside and outside corner trims
    - c. Pattern: Pattern to match floor tile.
    - d. Grout joint width: 1/8".
    - e. Color: Refer to Interior Color Schedule
    - f. Material: Unpolished Porcelain Ceramic.
    - g. Water Absorption: less than 0.5 percent.
      - 1) Breaking Strength: greater than 275 lbs.
      - 2) Chemical Resistance: Resistant.
      - 3) Bond Strength: greater than 65 psi.

- 4) Dynamic Coefficient of Friction: greater than or equal to 0.4

2. Interior Floor Tile **CT-1.**

- a. Manufacturer: DALTILE.
- 1) "Chord" Colorbody porcelain.
  - 2) Trim to match.
    - a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses," "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
  - 3) Transition: Schluter Systems - Schluter®-RENO-U
    - a) Provide at change in flooring material.
    - b) Height: 5/16"
    - c) Finish: Satin anodized aluminum
    - d) ADA Compliant
- b. Design: 12" x 24" x 5/16" thick.
- c. Pattern: Refer too Drawing.
- d. Grout joint width: 3/16".
- e. Color: District Campus Standard. See Interior Color Schedule.
- f. Material: Unpolished Porcelain Ceramic.
- 1) Water Absorption: less than 0.5 percent.
  - 2) Breaking Strength: greater than 275 lbs.
  - 3) Chemical Resistance: Resistant.
  - 4) Coefficient of Friction: greater than or equal to 0.42.
  - 5) Pattern to match floor tile.

3. Interior Wall Tile: **CT-2.**

- a. Manufacturer: DALTILE.
- 1) "Chord" colorbody porcelain.
  - 2) Trim to match.
    - a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses", "coves", "thin-lip bases", "round top bases", "beads", and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
  - 3) Transition: Schluter Systems - Schluter®-RENO-U
    - a) Provide at change in flooring material.
    - b) Height: 5/16"
    - c) Finish: Satin anodized aluminum
    - d) ADA Compliant
- b. Design: 3" Triangle Mosaic (Mesh-mounted) x 5/16" thick.
- c. Pattern: Refer to Drawings.
- d. Grout joint width: 1/8".
- e. Color: District Campus Standard. See Interior Color Schedule.
- f. Material: Unpolished Porcelain Ceramic.
- 1) Water Absorption: less than 0.5 percent.
  - 2) Breaking Strength: greater than 275 lbs.
  - 3) Chemical Resistance: Resistant
  - 4) Dynamic Coefficient of Friction: greater than or equal to 0.42.

4. Interior Wall Tile: **CT-3.**

- a. Manufacturer: DALTILE.
- 1) Color Wheel Collection Linear, Group 1.
  - 2) Trim to match.

- a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses", "coves", "thin-lip bases", "round top bases", "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
  - b. Design: 6" x 18" x 3/8" thick.
  - c. Pattern: Refer to Drawings.
    - 1) Grout joint width: 1/16".
  - d. Color: Refer to Interior Color Schedule.
  - e. Material: Interior Glazed Ceramic.
    - 1) Water Absorption: less than 20.0 percent.
    - 2) Scratch Hardness: 4.0 - 6.0
    - 3) Chemical Resistance: Resistant.
- 5. Interior "Accent" Wall Tile: **CT-4.**
  - a. Manufacturer: DALTILE.
    - 1) Color Wheel Collection Linear, Group 1.
    - 2) Trim to match.
      - a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses", "coves", "thin-lip bases", "round top bases", "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
  - b. Design: 4-1/4" x 8-9/16" x 5/16" thick.
  - c. Pattern: Refer to Drawings.
    - 1) Grout joint width: 1/16".
  - d. Color: Refer to Interior Color Schedule.
  - e. Material: Interior Glazed Ceramic.
    - 1) Water Absorption: less than 20.0 percent.
    - 2) Scratch Hardness: 4.0 - 6.0
    - 3) Chemical Resistance: Resistant.
- 6. Interior "Accent" Wall Tile: **CT-5.**
  - a. Manufacturer: DALTILE.
    - 1) Color Wheel Collection Linear, Group 1.
    - 2) Trim to match.
      - a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses", "coves", "thin-lip bases", "round top bases", "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.
  - b. Design: 2-1/8" x 8-9/16" x 5/16" thick.
  - c. Pattern: Refer to Drawings.
    - 1) Grout joint width: 1/16".
  - d. Color: Refer to Interior Color Schedule.
  - e. Material: Interior Glazed Ceramic.
    - 1) Water Absorption: less than 20.0 percent.
    - 2) Scratch Hardness: 4.0 - 6.0
    - 3) Chemical Resistance: Resistant.
- 7. Exterior Wall Tile: **CT-6.**
  - a. Manufacturer: BUCHTAL.
    - 1) Chroma Series, including "Intensive" colors.
    - 2) Trim to match.
      - a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses", "thin-set bullnoses", "coves", "thin-lip bases", "round top bases", "beads," and "countertop edge trims" as is appropriate to tile types) to match characteristics of adjoining flat tile.

- b. Design: 12.5 cm x 25 cm (approx. 5" x 10" x 5/16").
  - c. Pattern: Single size tile pattern, refer to Exterior Elevations.
    - 1) Grout joint width: 3 mm (3/32").
  - d. Color: Shall be selected from the manufacturer's full range of glaze colors. Refer to Exterior Color Schedule.
  - e. Material: Exterior Glazed Ceramic.
    - 1) Moisture Absorption Rate: 1.6 percent.
    - 2) All colors: 0.5 - 3.0 percent.
    - 3) Breaking Strength: Exceeds ANSI A 137.1, Sec. 6.3.
    - 4) Bond Strength: 507 PSI.
8. Exterior "Accent" Wall Tile: **CT-7.**
- a. Manufacturer: BUCHTAL.
    - 1) Chroma Series, including "Intensive" colors.
    - 2) Trim to match.
      - a) Tile Trim Units: Provide tile trim units (i.e. "bullnoses," "thin-set bullnoses," "coves," "thin-lip bases," "round top bases," "beads," and "countertop edge trims," as is appropriate to tile types) to match characteristics of adjoining flat tile.
  - b. Design: 6.2 cm x 25 cm x 0.6 cm (2.5" x 10" x 4/16").
  - c. Pattern: Single size tile pattern.
    - 1) Grout joint width: 3 mm (3/32").
  - d. Color: Shall be selected from the manufacturer's full range of glaze colors.
  - e. Material: Exterior glazed ceramic.
    - 1) Moisture Absorption Rate: 1.6 percent.
    - 2) All colors: 0.5 - 3.0 percent.
    - 3) Breaking Strength: Exceeds ANSI A 137.1, Sec. 6.3.
    - 4) Bond Strength: 507 PSI.
- C. Setting Bed:
- 1. Thick-Set:
    - a. Portland Cement: In accordance with ASTM C 150 "Specification for Portland Cement," Type 1.
    - b. Sand (Aggregate): In accordance with ASTM C 144 "Standard Specification for Aggregate for Masonry Mortar."
    - c. Hydrated Lime: In accordance with ASTM C 207 "Specification for Hydrated Lime for Masonry Purposes.," Type S.
    - d. Admixture: Shall be Mortar Latex Admix "Planicrete AC" as manufactured by MAPEI, or approved equivalent.
      - 1) This Admixture serves as a replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
  - 2. Thin-Set:
    - a. Dry-Set Portland Cement Mortar: In accordance with ANSI A 118.1-1999.
      - 1) Shall be "Kerabond" by MAPEI, or approved equivalent for floor and wall surfaces.
        - a) For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

- b. Modified Dry-Set Cement Mortar: In accordance with A118.4TE, A118.15TE and A118.11
  - 1) Shall be "Large Floor Tile Mortar" by MAPEI, or approved equivalent.
    - a) Approved Equivalent: 'ProLite Premium Large Format Tile Mortar' by CUSTOM BUILDING PRODUCTS.
  - 2) For floor applications in which the long edge of tile exceeds 8" (large format tiles).
- c. Latex-Portland Cement Mortar: In accordance with ANSI A 118.4-1999.
  - 1) Shall be "Keralastic" + "Kerabond" by MAPEI, or approved equivalent for floor and wall masonry or floor and wall concrete surfaces.
    - a) For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

D. Grout:

- 1. Cement:
  - a. ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- 2. Commercial Cement:
  - a. ANSI A118.6, composed of Standard Sanded Cement Grout, color as indicated.
- 3. Silicone-Rubber:
  - a. One-part, chemically curing, silicone-rubber-based elastomeric sealants used for factory-grouted joints within pre-grouted sheets of glazed wall tile and for field-grouted joints between the same pre-grouted sheet
    - 1) Silicone-Rubber grout shall not be used on kitchen countertops or other food preparation surfaces unless it meets the requirements of FDA Regulation No. 21, CFE 177.2600.
- 4. Dry-Set:
  - a. ANSI A 108.5-1999 and ANSI A 118.1-1999, a mixture of Portland Cement with sand and additives, color as indicated.
- 5. Epoxy:
  - a. ANSI A118.3-1999, Chemical-Resistant, Water-Cleanable, Ceramic Tile-Setting and Grouting Epoxy, color as indicated.

## 2.3 ACCESSORIES

A. Metal Trim:

- 1. Different-height Floor Transitions:
  - a. Manufacturer: SCHLUTER SYSTEMS, "RENO-U"
  - b. Material: Stainless Steel
  - c. Finish: Brushed
  - d. Height: Refer to Tile thickness.
  - e. Compliance: ADA Compliant
- 2. Same-height Floor Transitions:
  - a. Manufacturer: SCHLUTER SYSTEMS, "RENO-T"
  - b. Material: Stainless Steel
  - c. Finish: Brushed
  - d. Width: 1 in.
- 3. Outside Wall Corner and Edges:
  - a. Manufacturer: SCHLUTER SYSTEMS, "JOLLY"
  - b. Material: Extruded Aluminum.
  - c. Finish: Natural (AN).

4. Cove Base:
  - a. Manufacturer: SCHLUTER SYSTEMS, "DILEX-EKE"
  - b. Material: PVC and Soft CPE "Movement Zone".
  - c. Movement Zone Color: Standard Color to Match adjacent Grout.
- B. Membranes:
  1. Wall:
    - a. Polyethylene, 4 mil sheet with 6 inch laps at wet areas.
    - b. Polyethylene, 6 mil sheet with 6 inch laps at shower areas adjacent to concrete or masonry wall areas.
  2. Floor:
    - a. Mortar bed: Nonplasticized, chlorinated polyethylene sheet faced on both sides with nonwoven polyester fabric; 0.040 inch nominal thickness, water vapor transmission rate 0.040 perms per ASTM E 96 "Test Methods for Water Transmission of Materials," Procedure E.
      - 1) "Chloraloy" by THE NOBLE COMPANY.
    - b. Thin-Set: Nonplasticized, chlorinated polyethylene sheet faced on both sides with nonwoven polyester fabric; 0.030 inch nominal thickness, water vapor transmission rate 0.15 perms per ASTM E 96 "Test Methods for Water Transmission of Materials," Procedure E.
      - 1) "Nobleseal TS" by THE NOBLE COMPANY.
      - 2) Approved equivalent: "Dal-Seal CIS" by DAL TILE over a skim coat of "Keralastic" + "Kerabond" by MAPEI.
- C. Cementitious Backer Units:
  1. Provide cementitious backer units complying with ANSI A118.9-1999, in maximum lengths available to minimize end-to-end butt joints.
    - a. Thickness: Manufacturer's standard thickness, but not less than 1/2 inch unless otherwise noted.
    - b. Width: Manufacturer's standard width, but not less than 32 inches, unless otherwise noted.
- D. Miscellaneous Materials:
  1. Provide miscellaneous guides, shims, spacers, rust resistant fasteners, etc., applicable to substrates and finish materials necessary for flat and true surfaces that minimize cracks, bulges and uneven surfaces.
- E. Cleaners:
  1. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- F. Sealers:
  1. Grout and Tile Sealer: Manufacturer's standard product for sealing grout joints and tile surfaces that does not change color or appearance of grout or tile.



## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
- C. Execution of work under this specification section shall constitute acceptance of existing conditions.

## 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
  - 2. Prior to installation of Tile, inspect the installed work executed under other Sections which affect the installation of Tile.
    - a. Prepare masonry surfaces with a parge coat and cure so that all surfaces are flat prior to the installation of tile.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.
  - 3. Fill cracks, holes, and depressions in concrete substrates for tile floors with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
  - 4. Maximum backing surface variations shall be as follows:
    - a. Mortar Bed at Floors: 1/4 inch in 10 feet from required plane.

- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 INSTALLATION

A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.
5. Determine location of all movement/expansion joints before starting tile work.
6. Install Cementitious Backer Units in accordance with Cementitious Backer Unit Board Manufacturer's recommendations.
  - a. Shim Cementitious Backer Unit Boards as required for a flat and true surface plane with no bulges or uneven or flared surfaces.
  - b. Set shims at fasteners.
  - c. Fasten with corrosion resistant, waferhead, self-drilling screws with countersinking ribs, min. 8 gauge. Set flush with Board's surface. Fasten thru shims.
7. Determine location of all toilet accessories before starting tile work.
8. Isolate tile installations from concrete slabs at shower floor areas to minimize cracking of the tile installation systems. Install in accordance with the TCNA recommendations using cleavage membranes.
  - a. Provide crack isolation membranes as required in accordance with TCNA installation requirements.
9. Provide wall membranes as required by TCNA installation requirements.

B. Layout:

1. Lines shall be straight and true.
2. Refer to Wall and Floor Pattern Drawing(s) in the Interior and Exterior Color Schedules for layout of patterns.
3. Lay out all tile work to minimize cuts less than one-half in size.
4. Lay out tile wainscots to next full tile beyond dimension shown.

C. Joints

1. General: Movement/Expansion Joints shall be placed in accordance with the TCNA recommendations for placement.
2. Align all wall joints to give straight uniform grout lines, plumb and level.
3. Align all floor joints to give straight uniform grout lines, parallel with walls.
4. All joints shall be uniform in width.
5. Locate expansion joints in the tilework:
  - a. Over construction or expansion joints in the backing.
  - b. Where backing materials change or change directions.
  - c. At wall/floor intersections.

- d. Exterior work:
  - 1) Not more than 8 - 12 feet in each direction.
- e. Interior work:
  - 1) Not more than 20 - 25 feet in each direction.
    - a) Interior tilework exposed to direct sunlight or moisture: 8 to 12 feet in each direction.
    - b) Above ground concrete slab substrate: 8 to 12 feet in each direction.
- 6. Movement/expansion joint width sizes:
  - a. Working Butt Joints 1/4 inch minimum.
  - b. Working Lap Joints 1/8 inch minimum.
- D. Flatness and Lippage:
  - 1. Maximum lippage between adjacent units: 1/32 inch.
- E. Tile System Installations:
  - 1. Interior Floor:
    - a. System IFA: Concrete Sub-Floor, thin-set installation: **SYS-IFA.**
      - 1) Use: Dry or Limited water exposure.
      - 2) Method: Dry-set Mortar or Latex-Portland Cement Mortar.
      - 3) Detail Standard: TCNA F113-, 3/32" thin-set Dry-set or Latex-Portland Cement Mortar, Bond Coat, Tile, Grout.
      - 4) Installation Standard:
        - a) Tile: ANSI A 108.5.
        - b) Grout: ANSI A 108.10.
    - b. System IFB: Concrete Sub-Floor, mortar bed installation **SYS-IFB.**
      - 1) Use: Dry or Wet (Kitchens and Toilets).
      - 2) Method: Cement Mortar.
      - 3) Detail Standard: TCNA F114 - Cleavage Membrane, Reinforcing, 1-1/4" to 2"- Mortar Bed, Bond Coat, Tile, Epoxy Grout.
      - 4) Flush Grout with tile surface at kitchen floors only.
      - 5) Installation Standard:
        - a) Tile: ANSI A 108.1B.
        - b) Epoxy Grout: ANSI A 108.6.
  - 2. Interior Wall:
    - a. System IWD: Gypsum Board Wall, thin-set installation **SYS-IWD.**
      - 1) Use: Dry Exposure.
      - 2) Method: Dry-Set or Latex-Portland Cement Mortar.
      - 3) Detail Standard: TCNA W243 - Water Resistant Gypsum Board, 3/32" Thin-Set Dry-Set or Latex-Portland Cement Mortar, Bond Coat, Tile, Grout.
      - 4) Installation Standard:
        - a) Tile ANSI A 108.5.
        - b) Grout ANSI A 108.10.
    - b. System IWE: Wood Stud Walls, mortar bed installation **SYS-IWE.**
      - 1) Use: Dry or Wet Exposures (Kitchen, Toilets and Showers).
      - 2) Method: Cement Mortar.

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- 3) Detail Standard: TCNA W231 - Cleavage Membrane, Metal Lath, 3/4" to 1-1/2" Scratch Coat and Mortar Bed, Bond Coat, Tile, Grout.
  - 4) Installation Standard:
    - a) Tile ANSI A 108.1B.
    - b) Grout ANSI A 108.10.
    - c) Waterproof membrane ANSI A108.13.
3. Exterior Wall:
- a. System EWB: Solid Backing Walls, 3/8" to 3/4" reinforced mortar bed **SYS-EWB.**
    - 1) Use: Dry or Wet Exposure.
    - 2) Method: Cement Mortar.
    - 3) Detail Standard: TCNA W221 - Wall Membrane, Metal Lath, 3/8" To 3/4" Scratch Coat/Mortar Bed, Bond Coat, Tile, Grout.
    - 4) Installation Standard:
      - a) Waterproof Membrane ANSI A108.13.
      - b) Tile ANSI A 108.1A, 1B, or 1C A108.1B is required if waterproof membrane or epoxy bond coat is to be used.
      - c) Grout ANSI A 108.10.
4. Sealer Application:
- a. For tile and grout sealers, follow manufacturer's written recommendations and procedures, at application rates recommended by the label on the material container.
  - b. Apply penetrating grout sealer and cure in accordance with tile manufacturer's written recommendations for the resistance of moisture penetration into the grout surface.
  - c. For Stone Tile and Stone Grout sealers, apply at a rate of 500 to 1,500 sq. ft. per coat per gallon, depending on type of stone (slate), porosity and texture of the surface, temperature, humidity and method of application.
  - d. For exterior Stone Tile applications, provide two coats of sealer per manufacturer's written recommended rate of application, allowing the proper time between coats for curing (30 minutes) as recommended by the manufacturer.
    - 1) Protect newly coated surface from traffic and moisture for a period of twelve hours.
- F. Curing:
1. Apply Curing Sheet over all tiled surfaces.
    - a. Lap sheets 4 inches minimum and seal against escape of moisture.
    - b. Leave Curing Sheets in place a minimum of 3 days.

### 3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Clean any soiled surfaces immediately.
- C. Finish shall be clean and ready for the application of any additional finishes.
- D. In accordance with manufacturer's written instructions and recommendations.

- E. Wash down cured tile work with cleaner mixed and applied in accordance with manufacturer's written instructions.
- F. Rinse tile-work thoroughly, with clean water, and polish with soft-cloth.

### 3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Protect newly installed work from freezing for 24 hours after erection, installation or application.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

SECTION 09 65 10 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Resilient Base and Accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 03 35 10 POLISHED CONCRETE FINISHING
  - 5. 06 41 23 MODULAR CASEWORK
  - 6. 09 24 00 CEMENT PLASTER
  - 7. 09 29 00 GYPSUM BOARD
  - 8. 09 68 40 CARPET
  - 9. 09 72 00 WALL COVERINGS
  - 10. 09 91 00 PAINTING
  - 11. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

- A. Standards:
  - 1. In accordance with Specification Section - Regulatory Requirements, and the following standards:
    - a. ADAAG Americans with Disabilities Act Accessibilities Guidelines.
    - b. RFCI The Resilient Floor Covering Institute.

1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data:
    - a. For each type of resilient base and accessory indicated.
    - b. Manufacturer's full color range (including any standard and premium colors).
    - c. Design Data for all compounds, fillers, adhesives, etc.
  - 2. Samples.
    - a. Provide 6 inch linear samples of each piece of trim material specified.
  - 3. Quality Assurance/Control Submittals:
    - a. Manufacturer's Written Installation Instructions.
    - b. Certificate from resilient base installer that all products supplied for installation comply with local regulations in the area where the project is located controlling the use of Volatile Organic Compounds (VOC's).
    - c. Statement of Installer's Qualifications.
  - 4. Closeout Submittals in accordance with Specification Sections in Division One:
    - a. Maintenance Data (including recommended polish and buffing procedures) in accordance with Specification Section - PROJECT CLOSEOUT.
    - b. Record Documents in accordance with Specification Section – PROJECT DOCUMENTS.

- c. Warranty in accordance with this Specification Section, and Specification Section – WARRANTIES.

#### 1.4 QUALITY ASSURANCE

##### A. Qualifications:

- 1. Installer Qualifications:
  - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project, and is competent in the techniques required by the manufacturer.
- 2. Manufacturer/Supplier Qualifications:
  - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

##### B. Regulatory Requirements:

- 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. CBC California Building Code (CBC 11B-302.1)

##### C. Meetings:

- 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - c. Review delivery, storage, and handling procedures.
  - d. Review Project Conditions.
  - e. Review subfloor preparation procedures.
- 2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
- 3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
  - b. Maintain installed work until the Notice of Substantial Completion has been executed.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### A. Packing, shipping, handling, and unloading:

- 1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

##### B. Acceptance at Site:

- 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, type, color, and size.
- 2. Damaged products will not be accepted.

##### C. Storage and protection:

- 1. Products shall be stored in a dry, protected, interior area above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
  - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.
  - b. Maintain temperature in the storage space between fifty (50) degrees Fahrenheit and ninety (90) degrees Fahrenheit.

- 1) Seven (7) days prior to installation, acclimate products to environmental requirements of the article titled PROJECT CONDITIONS of this specification section, and the Paragraph titled "Environmental Requirements."

**1.6 PROJECT CONDITIONS**

- A. Environmental requirements:
  1. Temperature: Maintain temperature in space to receive products at sixty-eight (68) degrees Fahrenheit for two (2) days prior, during, and two (2) days following installation.
    - a. After this period, maintain a temperature of not less than fifty-five (55) degrees Fahrenheit.
    - b. After installation, at no such time shall the temperature exceed eighty-five (85) degrees Fahrenheit.

**1.7 WARRANTY**

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Rubber Base Two (2) Years.
    - b. Transitions Two (2) years.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty Period Two (2) Years.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Rubber Base manufacturer:
    - a. MANNINGTON COMMERCIAL
    - b. Acceptable alternative manufacturers:
      - 1) ROPPE CORPORATION.
  2. Transitions manufacturer:
    - a. MANNINGTON COMMERCIAL.
    - b. Acceptable alternative manufacturers:
      - 1) ROPPE CORPORATION.
  3. Underlayment Compound manufacturer:
    - a. ARDEX INCORPORATED.
    - b. Acceptable alternative manufacturers:
      - 1) CHEMREX.
        - a) A compatible bonding agent is needed for this product to adhere to the Vapor-Alkalinity Control System and be considered as equivalent.
  4. Crack and Joint Filler manufacturer:



- a. ARDEX INCORPORATED.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. General:
  - 1. Resilient base and accessories shall be of first quality and the product of one manufacturer.
  - 2. Minimize seams.
- B. Rubber Base:
  - 1. Shall comply with ASTM F 1861 "Standard Specification for Resilient Wall Base," for Type TS (Vulcanized Rubber), Group 1 (Solid and Homogeneous).
    - a. Critical Radiant Flux shall be Class 1, not less than 0.45 W/sq.cm. per ASTM E 648 "Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source."
  - 2. Base shall be Coved.
  - 3. Thickness: 0.125".
  - 4. Base height shall be 4".
  - 5. Length: as long as possible to reduce seams.
  - 6. Provide factory molded inside and outside base corners from the same dye lot as the rubber base.
  - 7. Shall comply to dimension requirements of section 4.5.2 (changes in level) and section 4.5.3 (carpet-edge trim) of the ADAAG.

## 2.3 ACCESSORIES

- A. Underlayment Compound:
  - 1. Provide free-flowing, self-leveling, pumpable, cement based compound (ARDEX K-15) for applications from 1 inch thick to feathered edges, 4000 psi minimum in accordance with ASTM C 109-modified for air cure only "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)."
    - a. ARDEX "K-15."
- B. Crack and Joint Filler:
  - 1. Provide low viscosity rigid polyurethane filler, tensile strength of 4,000 psi minimum, in accordance with ASTM D 638 "Test method for Tensile Properties of Plastics."
    - a. ARDEX "ARDIFIX".
- C. Concrete Primer (if applicable):
  - 1. Nonstaining type as recommended in writing by flooring manufacturer.
- D. Adhesives:
  - 1. Adhesive as recommended in writing by resilient base manufacturer.
  - 2. Shall comply with requirements in the place where the project is located.
  - 3. Shall be water and mildew resistant.
  - 4. Shall bond to non-porous substrate surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affect the execution of work under this specification section.

2. Insure that all flooring has been installed, fitted close to the wall to provide even support to the resilient base, and to insure a tight, smooth fit along the floor.
3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
4. Execution of work under this specification section shall constitute acceptance of existing conditions.

### **3.2 PREPARATION**

- A. Coordination:
  1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work.
- C. Surface preparation:
  1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  2. Wall substrates to receive resilient base must be completely clean, dry, smooth and free of oil, grease, rust, paint, varnish, shellac, or any other foreign substance.
  3. Fill all cracks, joints, etc. with a Crack and Joint Filler according to manufacturer's written instructions.
  4. Vacuum clean substrates to be covered immediately before installation.
  5. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
  6. Proceed only after unsatisfactory conditions have been corrected.
  7. Perform manufacturer recommended bond test to verify adhesion of resilient base and accessory to substrate.

### **3.3 INSTALLATION**

- A. General:
  1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
  2. In accordance with approved submittals.
  3. In accordance with Regulatory Requirements.
  4. Set plumb, level, and square.
- B. Layout:
  1. Lines shall be straight and true.
- C. Resilient Base installation:
  1. For base installations on primed metal or enameled surfaces, provide manufacturer's written recommended co-adhesive method of installation applied to both surfaces with contact bond adhesive.
  2. On dry, absorbent surfaces, the base shall be adhered with manufacturer's written recommended adhesive and firmly pressed to the walls.
  3. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
  4. Install in lengths as long as possible to minimize seams.
  5. Minimize gaps at seams.
  6. Align tops of adjacent pieces.
  7. Tightly adhere resilient base to substrate throughout length of piece, with base in continuous contact with horizontal and vertical substrates.
  8. Do not stretch resilient base during installation.

9. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
10. Pre-molded Corners: Install pre-molded corners before installing straight pieces.
11. After the installation, remove all excess adhesive before it dries.
12. Allow adhesive to set firm for approximately 24 hours before washing or applying any pressure.

**3.4 CLEANING**

**A. Cleaning:**

1. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
2. Clean any soiled surfaces immediately.
3. Clean any soiled surfaces at the end of each day, minimum.
4. Finish shall be clean and ready for the application of any additional finishes.
5. In accordance with manufacturer's written instructions and recommendations.

**3.5 PROTECTION**

**A. Protection from traffic:**

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

**END OF SECTION**

SECTION 09 68 40 - CARPET

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all carpet materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 03 35 10 POLISHED CONCRETE FINISHING
  - 5. 06 41 23 MODULAR CASEWORK
  - 6. 07 18 50 VAPOR-ALKALINITY CONTROL
  - 7. 08 11 00 METAL DOORS AND FRAMES
  - 8. 09 29 00 GYPSUM BOARD
  - 9. 09 30 00 TILE
  - 10. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 11. 09 72 00 WALL COVERINGS
  - 12. 09 91 00 PAINTING
  - 13. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. AATCC American Association of Textile Colorists and Chemists.
    - b. ASTM American Society of Testing Materials.
    - c. CRI Carpet and Rug Institute Recommendations and Standards.

1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. For each type of carpet indicated:
    - b. Manufacturer's full color range (including any standard and premium colors).
    - c. Design data for all adhesives, tape, etc. for all carpet accessories.
  - 2. Shop Drawings.
    - a. Seaming diagrams.
      - 1) Changes at carpet types, patterns, colors, and field seams shall be identified.
  - 3. Samples.
    - a. Provide 18" x 18" sample of each color and pattern selected.
  - 4. Quality Assurance/Control Submittals:
    - a. Manufacturer's Written Installation Instructions.
    - b. Certificates:
      - 1) Certificates from the manufacturer that the installation was in compliance with manufacturer's written instructions.
    - c. Statement of Installer's Qualifications.
  - 5. Closeout Submittals in accordance with the following:

- a. Maintenance Data (indicating all recommended cleaning and maintenance instructions) in accordance with Specification Section - PROJECT CLOSEOUT.
- b. Project Record Documents in accordance with Specification Section - PROJECT RECORD DOCUMENTS.
- c. Warranty in accordance with this specification and Specification Section - WARRANTIES.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CBC California Building Code (CBC 804.1 and CBC 11B-302.1 and 11B-302.2)
    - b. CDPH California Department of Public Health, "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers"
    - c. NFPA National Fire Protection Agency
    - d. SCAQMD South Coast Air Quality Management District, Rule 1168
- C. Meetings:
  - 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with all other related work.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
    - c. Review delivery, storage and handling procedures.
    - d. Review project conditions.
    - e. Review subfloor preparation procedures.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
    - b. Maintain installed work until the Notice of Substantial Completion has been executed.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be individually wrapped in the original protective wrapping with legible registration labels indicating manufacturer's name, style, color and dye lot.
- B. Storage and protection:
  - 1. Products shall be stored in a dry, protected interior area.
    - a. Carpet shall be stored flat and shall not have anything stacked on top.
    - b. Maintain temperature in the storage space between fifty (50) degrees Fahrenheit and ninety (90) degrees Fahrenheit.
      - 1) Seven (7) days prior to installation, acclimate products to environmental requirements of the article titled PROJECT CONDITIONS of this specification section, and the Paragraph titled "Environmental Requirements."

**1.6 PROJECT CONDITIONS****A. Environmental requirements:**

1. Temperature: Maintain ambient temperature in space to receive products between sixty-eight (68) degrees Fahrenheit and eighty (80) degrees Fahrenheit for seven (7) days prior, during, and seven (7) days minimum following installation.
  - a. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.
2. Humidity: Maintain humidity in space to receive products between 6 percent to 9 percent for four (4) days minimum prior, during, and following installation in accordance with manufacturer's written recommendations.
  - a. Inform the Owner of humidity requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

**1.7 WARRANTY****A. Contractor's General Warranty:**

1. In accordance with Specification Section - WARRANTIES.

**B. Manufacturer's Warranty:**

1. In accordance with manufacturer's written standard warranty:
  - a. Modular Tile Life of the Carpet.
2. Shall cover Wear, Anti-shock, Edge Ravel, Tuft Bind, Dimensional Stability, Zippering, Static Protection, and Backing Delamination.

**C. Installer's Warranty:**

1. In accordance with the terms of the specification section - WARRANTIES:
  - a. Warranty Period Two (2) Years.
  - b. Shall be co-endorsed by the General Contractor.

**1.8 OWNER'S INSTRUCTIONS****A. Provide the services of a manufacturer's-authorized service representative to demonstrate and train the Owner's maintenance personnel prior to substantial completion as specified below:**

1. Proper maintenance and cleaning procedures in accordance with manufacturer's written recommended instructions.

**1.9 MAINTENANCE****A. Extra Materials:**

1. Modular Tile:
  - a. Provide five percent (5 percent) of each color, in accordance with Specification Section - PROJECT CLOSEOUT.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS****A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.**

1. Specified underlayment compound manufacturer:

- a. ARDEX INCORPORATED
- b. Acceptable alternative manufacturer: CHEMREX
  - 1) A compatible bonding agent is needed for this product to adhere to the Vapor-Alkalinity Control System and be considered as equivalent.
- 2. Specified crack and joint filler manufacturer:
  - a. ARDEX INCORPORATED.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. General:
  - 1. All materials shall be newly manufactured and of a quality consistent with industry standards and this specification.
  - 2. Colors and patterns shall be selected from manufacturer's standard line (including premium) except as otherwise specified. See Carpet Schedule at the end of this section for carpet types required.
  - 3. Carpet shall have integral static protection.
  - 4. Carpet shall be impervious to water damage.
  - 5. The stain resistant properties must be permanent and cannot be removed by commercial cleanings or abrasive wear. Test data as follows:
    - a. Red Dye 40 must be released by water only, after exposure to 150,000+ cycles in a tetra pod walker and after sample is allowed to soak in 10:1 solution of water and ammonia.
  - 6. Topical stain resistant treatments will not be acceptable. Stain resistant properties must be inherent.
  - 7. Carpet must meet or exceed qualifications for environmental standards of the Carpet and Rug Institute's Green Label Program.

## 2.3 ACCESSORIES

- A. Underlayment Compound:
  - 1. Provide free-flowing, self-leveling, pumpable, cement based compound (ARDEX K-15) for applications from 1 inch thick to feathered edges, 4,000 psi minimum in accordance with ASTM C 109 "Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)," modified for air cure only.
    - a. ARDEX "K-15."
- B. Crack and Joint Filler:
  - 1. Provide low viscosity rigid polyurethane filler, tensile strength of 4,000 psi minimum, in accordance with ASTM D 638 "Test method for Tensile Properties of Plastics."
    - a. ARDEX "ARDIFIX."
- C. Concrete Primer (if applicable):
  - 1. Nonstaining type as recommended in writing by flooring manufacturer.
- D. Adhesives:
  - 1. Adhesive as recommended in writing by carpet manufacturer.
  - 2. Compatible with VAPOR-ALKALINITY CONTROL SYSTEM, if installed.
  - 3. Shall comply with requirements in the place where the project is located.
  - 4. Shall be non-staining and water and mildew resistant.
  - 5. Complies with flammability requirements for installed carpet.
  - 6. Shall bond to non-porous substrate surfaces.
- E. Seaming Cement:
  - 1. Hot-melt adhesive tape or similar product
  - 2. Complying with requirements in the place where the project is located.

3. Recommended in writing by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
2. Check sub-floor variation with long straight edge.
3. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
4. Execution of work under this specification section shall constitute acceptance of existing conditions.

#### B. Concrete Subfloors:

1. Verify that concrete slabs comply with ASTM F 710 "Practice for Preparing Concrete Floors to Receive Resilient Flooring."
2. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
3. Verify that subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Evaluate the RH (Relative Humidity) and pH (Alkalinity) test results for compliance with adhesives and carpet manufacturer recommendations.
  - a. If a Vapor-Alkalinity Control System product has been installed to reduce water vapor emission or phosphates thereby negating the RH and pH test results, evaluate products for compatibility with adhesives and carpet products.
5. Determine adhesion characteristics by performing bond tests recommended by the carpet manufacturer.

### 3.2 PREPARATION

#### A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

#### B. Protection:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work.

#### C. Surface preparation:

1. General: Comply with CRI, Section 7, "Site Conditions- All Installations" and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
2. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the carpet manufacturer.
  - a. If a Vapor-Alkalinity Control System has been installed do not remove this system.
3. Use crack and joint filler according to manufacturer's written instructions, to fill cracks, holes, and spalls in substrates.
4. Install self-leveling underlayment compound at depressed or uneven floor conditions.
5. Broom and vacuum clean substrates to be covered immediately before installing carpet.
6. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
7. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.3 INSTALLATION

#### A. General:

1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.

#### B. Layout:

1. Lines shall be straight and true.
2. Refer to Wall and Floor Pattern Drawing(s) in the Interior and Exterior Color Schedules for layout of patterns.

#### C. Carpet Installation:

1. Direct-Glue-Down Installation: Comply with CRI, Section 13, "Direct Glue-Down Installation."
2. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
  - a. Level adjoining edges at seams with hand shears.
  - b. Level adjoining edges.
3. Do not bridge building expansion joints with carpet.
4. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosing's. Bind or seal cut edges as recommended in writing by carpet manufacturer.
5. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

#### D. Modular Tile:

1. Pattern: Monolithic with a random distribution of colors specified, unless otherwise noted.

### 3.4 CLEANING

#### A. Perform the following operations immediately after installing carpet:

1. Remove and dispose of debris and recycle all unusable scrap.
2. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet manufacturer.
3. Remove yarns that protrude from carpet surface.
4. Vacuum carpet using commercial machine with face-beater element.

### 3.5 DEMONSTRATION

#### A. In accordance with Specification Section - PROJECT CLOSEOUT.

1. Provide the services of a manufacturer-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
  - a. Train Owner's maintenance personnel on cleaning procedures and schedules related to cleaning and preventative maintenance.
  - b. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.

### 3.6 PROTECTION

#### A. Protect installed carpet to comply with CRI, Section 20, "Protecting Indoor Installations."

- B. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

### 3.7 SCHEDULES

- A. **Modular Tile** **MT-1.**
1. Manufacturer: **MOHAWK GROUP.**
  2. Product Name: **Hyper Earth.**
  3. Physical Characteristics:
    - a. Construction Type: **Tufted.**
    - b. Fiber Type: **ColorStrand® SD Nylon.**
    - c. Pile Characteristic: **Textured Patterned Loop.**
    - d. Density: **6,620 oz/cu. yd.**
    - e. Stitches: **10 per inch.**
    - f. Gage: **1/12 ends per inch.**
    - g. Face Weight: **16.20 oz/sq. yd.**
    - h. Primary Backing: **EcoFlex Matrix**
    - i. Size: **12" x 36".**
    - j. Soil Resistance Treatment: **EcoSentry Plus Stain Protection.**
  4. Performance Characteristics:
    - a. Critical Radiant Flux per ASTM E 648 "Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source."
      - 1) Class 1, Not less than 0.45 W/sq. cm.
    - b. Smoke Density per ASTM E 662 "Test method for Specific Optical Density of Smoke Generated by Solid Materials."
      - 1) Less than 450.
    - c. Methenamine Pill Test per ASTM D 2859 "Test method for Ignition Characteristics of Finished Textile Floor Covering Materials."
      - 1) Shall be self-extinguishing.
    - d. Tuft Bind per ASTM D 1335 "Test Method for Tuft Bind of Pile Yarn Floor Coverings."
      - 1) Not less than 10 lbf.
    - e. Delamination per ASTM D 3936 "Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering."
      - 1) Not less than 2.5 lbf/in.
    - f. Electrostatic Propensity: **Less than 3.5 kV per AATCC 134.**

END OF SECTION

## SECTION 09 72 00 - WALL COVERINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all materials, labor, equipment and services necessary to furnish and install all Wall Coverings, accessories, and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
    - a. FRP Panel systems.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 06 41 23 MODULAR CASEWORK
  - 4. 09 24 00 CEMENT PLASTER
  - 5. 09 29 00 GYPSUM BOARD
  - 6. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 7. 09 68 40 CARPET
  - 8. 10 11 00 VISUAL DISPLAY BOARDS
  - 9. 10 26 00 WALL AND CORNER GUARDS
  - 10. 10 28 13 TOILET ACCESSORIES
  - 11. 10 44 00 FIRE PROTECTION SPECIALTIES
  - 12. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Submit manufacturer's full color range (including any standard, premium and custom colors) of all Wall Coverings for selection by the Architect.
  - 2. Samples.
    - a. Provide 6 inch square sample of each Wall Covering product for color and pattern selected.
    - b. Provide 6 inch lineal samples of each Wall Covering trim material specified.
  - 3. Closeout Submittals in accordance with the following:
    - a. Warranty in accordance with Specification Section - WARRANTIES.

## 1.3 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    - b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
  - 2. Manufacturer/Supplier Qualifications:

- a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. CBC California Building Code (CBC 803).

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be individually wrapped.
  - 2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
- B. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Damaged products will not be accepted.
- C. Storage and protection:
  - 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

#### 1.5 PROJECT CONDITIONS

- A. Environmental requirements:
  - 1. Temperature: Maintain ambient temperature in space to receive products between sixty (60) degrees Fahrenheit and eighty (80) degrees Fahrenheit for three (3) days prior, during, and three (3) days minimum following installation. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

#### 1.6 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
1. Specified FRP Panel product manufacturer:
    - a. CRANE COMPOSITES "Sequentia" with NUDO Trim Accessories.
    - b. Acceptable alternative manufacturers:
      - 1) BP CHEMICALS with NUDO Trim Accessories.
      - 2) MARLITE with NUDO Trim Accessories.
      - 3) NUDO PRODUCTS, INC. with NUDO Trim Accessories.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. FRP Panels:
1. Width 48 inches.
  2. Thickness 0.090 inches.
  3. Fire Rating per ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials": Class C.
    - a. Flame Spread Maximum 175.
    - b. Smoke Developed Maximum 270.
  4. Finish: Smooth finish.
  5. Color: As selected from manufacturer's standard, premium, and custom color palette.
  6. Accessories:
    - a. Adhesive as recommended in writing by manufacturer that meets the requirements of the place where the Project is located.
    - b. Sealant.
      - 1) Set all perimeter J-Mold trim in a continuous bead of silicon sealant.
  7. Trim:
    - a. Provide inside, outside, division and edge trim moldings as required for the conditions present in the project.
    - b. Material: Aluminum.
    - c. Lengths 96 inches
    - d. Thickness 0.090 inch
    - e. Trim Shapes:
      - 1) J-Mold NUDO A-28.
      - 2) Divider NUDO A-30.
      - 3) Inside Corners NUDO A-32.
      - 4) Outside Corners NUDO A-34.
    - f. Finish: Powder Coated in colors to match the field color of the FRP Panels.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

## 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

## 3.3 INSTALLATION

- A. General:
  - 1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
  - 2. In accordance with approved submittals.
  - 3. In accordance with Regulatory Requirements.
  - 4. Set plumb, level, and square.
- B. Layout:
  - 1. Lines shall be straight and true.

## 3.4 INSTALLATION OF FRP PANELS

- A. Install panels in a full spread of adhesive.
- B. Install factory-laminated panels using concealed mounting splines in panel joints.
- C. Install trim accessories with adhesive. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

3.5 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces immediately.
  - 2. Finish shall be clean and ready for the application of any additional finishes.
  - 3. In accordance with manufacturer's written instructions and recommendations.

END OF SECTION

## SECTION 09 91 00 - PAINTING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to furnish and install Painting, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
  - 2. Material and Equipment to be Painted: Paint all piping, unwrapped ductwork, electric conduits exposed to view. Prime and paint all factory finished mechanical and electrical equipment and accessories exposed to view.
  - 3. Material and Equipment not to be Painted: Do not paint piping, ductwork, equipment and machinery located in attic spaces, above furred or suspended ceilings, in furred pipe or duct spaces. Do not paint factory finished equipment or machinery located in mechanical rooms or mechanical buildings, attics, furred or suspended ceilings.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 06 41 23 MODULAR CASEWORK
  - 5. 07 40 00 METAL PANELS
  - 6. 07 60 00 SHEET METAL (Shop Priming)
  - 7. 07 72 00 ROOF ACCESSORIES
  - 8. 07 92 00 SEALANTS
  - 9. 08 11 00 METAL DOORS AND FRAMES
  - 10. 08 31 13 ACCESS DOORS AND FRAMES
  - 11. 08 70 00 HARDWARE
  - 12. 08 80 00 GLASS
  - 13. 09 24 00 CEMENT PLASTER
  - 14. 09 29 00 GYPSUM BOARD
  - 15. 09 65 10 RESILIENT BASE AND ACCESSORIES
  - 16. 09 68 40 CARPET
  - 17. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 18. 10 21 13 TOILET PARTITIONS
  - 19. 10 26 00 WALL AND CORNER GUARDS
  - 20. 10 44 00 FIRE PROTECTION SPECIALTIES
  - 21. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. In accordance with the following standards:
    - a. MPI Master Painters Institute
      - 1) MPI - Architectural Painting Specification Manual.
      - 2) MPI - Maintenance Repainting Manual.
    - a) MPI RSP Master Painters Institute Repaint Surface Preparation Standards, Chapter 6, Section 2.



- 3) MPI – Glossary.
- b. PDCA Painting and Decorating Contractors of America, latest edition of the Architectural Specification Manual, as prepared by Specification Services, Inc., Washington State Council of the PDCA.

### 1.3 DEFINITIONS

- A. The following definitions are just some of the more important definitions used within this section, and were taken from the MPI Glossary Manual, or used to simplify language used by the Architect. These definitions and others stated within the Manual apply for this Specification Section.
  1. Acrylic Latex An aqueous dispersion of acrylic resins.
  2. Acrylic Resin A/R - Synthetic resins made by polymerizing esters of acrylic acid.
  3. A/U Aliphatic Urethane
  4. A/A/U Aliphatic Acrylic Urethane
  5. Blocking Sticking or bonding together of two painted surfaces that are in direct contact. Most often caused by stacking painted articles before dry or reaching a "block free" (or "non-blocking") stage.
  6. DFT Dry Film Thickness – the depth or thickness of a coating in the dry state. Expressed in mils (1/1000 inch) or microns.
  7. DRY FALL A Fog Paint designed to be applied by spray and dries fast enough that the overspray will be a dry powder after falling a certain distance. The dust can then be swept or vacuumed up.
  8. ODFT "Overall Dry Film Thickness" – the depth or thickness of a complete coating system in the dry state. Expressed in mils (1/1000 inch) or microns.

### 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  1. Product Data.
    - a. Submit manufacturer's full color range, including standard, premium and custom colors, for selection by the Architect.
    - b. Material Safety Data Sheets will be turned over to the Owner in compliance with local rules and regulations, but will not be reviewed.
    - c. Materials List: Format in accordance with Paint Finish Schedule.
    - d. Additional submittals to substantiate proposed equivalent systems.
  2. Samples.
    - a. Brushouts: In accordance with Specification Section - SUBMITTAL PROCEDURES.
    - b. For each color and finish selected provide paint brushouts showing color tint graduation of each coat to and including the final color coat.
      - 1) Selected colors and finishes:
        - a) Size: 8 1/2" x 11" boards.
        - b) Quantity: 3 boards of each color and finish.
        - c) Board material wherever possible and for transparent finishes shall be same as material to be finished. Opaque finishes may be on heavy card stock.
  3. Closeout Submittals in accordance with the following:
    - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.

- b. Project Documents in accordance with Specification Section - PROJECT DOCUMENTS.
- c. Warranty in accordance with Specification Section - WARRANTIES.

## 1.5 QUALITY ASSURANCE

### A. Qualifications:

1. Material Qualifications:
  - a. Where possible (except for specified materials), paint materials shall be products of only one manufacturer.
  - b. All materials, preparation and workmanship shall conform to requirements of the specified edition of the Architectural Painting Specification Manual by the Master Painters Institute (hereafter referred to as the MPI Painting Manual), unless otherwise indicated.
  - c. Flame Spread Ratings in accordance with ASTM E 84 "Standard Test Method for Surface Burning Characteristics of Building Materials":
    - 1) Paint finishes in required exit stairways, corridors and exitways must meet flame spread ratings as required by regulatory agencies.
    - 2) Class A - Tunnel Test 0-25 for enclosed required exit stairways and other exit ways.
    - 3) No interior paint or wall finish will be permitted having a tunnel test in excess of 200. All paint materials must be certified that materials meet these requirements.
  - d. Manufacturer's Written Instructions - One for the Architect, Contractor and the Owner:
    - 1) Submit three (3) copies of manufacturer's written instructions.
  - e. Compatibility:
    - 1) Paint materials and equipment shall be compatible in use.
    - 2) Finish coats shall be compatible with prime coat.
    - 3) Prime coats shall be compatible with surface to be coated.
    - 4) Tools and materials shall be compatible with coating to be applied.
  - f. Air Quality:
    - 1) Paint materials and equipment used for application will comply with CARB Air Quality Control Standards in effect at the Project Site and at the time of application.
2. Installer Qualifications:
  - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    - 1) Only qualified journeypersons, as defined by local jurisdiction, shall be engaged in painting and decorating work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyperson in accordance with trade regulations.
3. Manufacturer/Supplier Qualifications:
  - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.

### B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. CAL/OSHA      California/Occupational Safety and Health Act

- C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required for Architect's review. Duplicate finish of approved sample Submittals.
  - 1. Wall Finishes shall be at least 100 sq. ft., suitably marked "MOCKUPS" and protected for the duration of the construction Project.
  - 2. Small areas and items can be selected by the Contractor, suitably marked "MOCKUPS" and protected for the duration of the construction Project.
  - 3. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
  - 4. Approved mockups (wall areas and small areas or items) may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Meetings:
  - 1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
    - a. Coordinate the work with all other related work.
    - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - 2. Progress: Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work progress.
    - b. Identify any installation problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion: Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems that may impede issuance of warranties and guaranties.
    - b. Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  - 2. Damaged products will not be accepted.
- B. Storage and protection:
  - 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units, in a locked, clean and neat, well ventilated area.
    - a. All receiving, opening and mixing shall be done in this area.
    - b. Oily rags and waste shall be removed from area each night and all other precautions shall be taken to avoid danger of fire.
    - c. Empty containers shall not be removed from site, unless otherwise approved by the Architect.
    - d. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.7 PROJECT CONDITIONS

- A. Environmental requirements:
  - 1. Rain or Fog:
    - a. No work under this section shall be started or maintained under threat of rain.

- b. Surfaces shall be painted only when they are free from moisture.
  - c. No painting of exterior surfaces shall be done less than 72 hours of actual drying weather after a rain or during periods of dew or fog.
  - d. Perform no painting or decorating work when the maximum moisture content of the substrate exceeds:
    - 1) 12 percent for concrete and masonry (clay and concrete brick / block).
    - 2) 15 percent for wood.
    - 3) 12 percent for plaster and gypsum board.
  - e. Perform no painting or decorating work when the relative humidity is above 85 percent or when the dew point is less than 5 degrees F variance between the air / substrate temperature.
- 2. Temperature: No painting shall be done when ambient air and substrate temperatures are below 50 degrees F.
  - 3. Alkalinity: An alkali level of between 7.0 and 8.5 pH is suitable for painting. Any reading above that level, then the surface shall be neutralized as required for the surface to be painted.
    - a. Methods shall be consistent with MPI - Architectural Painting Specification Manual, and shall not result in any adverse condition causing inadequate adhesion, improper curing and drying, or durability of paint system.
  - 4. No exterior painting shall be done during winds or dusty conditions.
  - 5. Perform no exterior painting and decorating work unless environmental conditions are within MPI and paint manufacturer's requirements or until adequate weather protection is provided.
    - a. Where required to meet project schedules, suitable weatherproof covering and sufficient heating facilities shall be in place to maintain minimum ambient air and substrate temperatures for 24 hours before, during and after paint application.
  - 6. Perform no interior painting or decorating work unless adequate continuous ventilation and sufficient heating facilities are in place to maintain minimum ambient air and substrate temperatures above minimum requirements for 24 hours before, during and after paint application.
    - a. Where required to meet project schedules, provide supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- B. Existing Conditions:
- 1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  - 2. Concrete and masonry surfaces shall be installed at least 28 days prior to painting and decorating work and shall be visually dry on both sides.
  - 3. Conduct all moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.
  - 4. Test concrete, masonry and plaster surfaces for alkalinity as required.
  - 5. Contractor shall provide a minimum lighting level of 323 Lux (30 foot candles) on surfaces to be painted or decorated.

## 1.8 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.

- a. Original adherence of all materials and no evidence of any surface defect shall be maintained during warranty period.
  - b. Color at end of warranty period shall remain free from serious fading and any discernible variations shall be uniform.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
  2. Provide Paint Manufacturer's special ten (10) year Material Warranty co-endorsed by the installer for exterior paint application of cement plaster surfaces.
    - a. Warranty period: Ten (10) Years.
  3. Provide Water-Repellent Manufacturer's special Weatherproofing Warranty co-endorsed by the installer for exterior sealer application of concrete or concrete block surfaces.
    - a. Warranty period: Ten (10) Years.
- C. Installer's Warranty:
  1. Paint Installer's Warranty:
    - a. Warranty period: Two (2) Years.
    - b. Installer will certify that a Paint Manufacturer's Representative tested the substrate according to Paint Manufacturer's standard procedures and have submitted project information and test patch forms.
    - c. Installer shall certify that Paint Manufacturer's products were installed on the structure in accordance with manufacturer's specification requirements.
    - d. Installer further agrees that if installer fails to fulfill their obligation under this certification statement within 30 days notice of the complaint, Paint Manufacturer may proceed with the investigation and repairs and shall pay the entire material cost, providing it wasn't the installer's responsibility.
  2. Water-Repellent Installer's Warranty:
    - a. Warranty period: Two (2) Years.
    - b. Installer will certify that a Water-Repellent Manufacturer's Representative tested the substrate according to Water-Repellent Manufacturer's standard procedures and have submitted project information and test patch forms.
    - c. Installer shall certify that Water-Repellent Manufacturer's products were installed on the structure in accordance with manufacturer's specification requirements.
    - d. Installer agrees:
      - 1) Investigate all complaints of leakage and/or water absorption on surfaces to which Water-Repellent Manufacturer's weatherproofing products were applied and provide a written report of the cause to Water-Repellent Manufacturer within thirty (30) days of the complaint.
      - 2) Re-apply Water-Repellent Manufacturer's weatherproofing products according to Water-Repellent Manufacturer's standard procedures at installer's cost for labor and material if the leakage and/or water absorption is due to improper surface preparation, application and/or improper use of material.
      - 3) Request authority from Water-Repellent Manufacturer to re-apply Water-Repellent Manufacturer's weatherproofing products at Water-Repellent Manufacturer's expense to areas, which were not rendered hydrophobic due to imperfect weatherproofing materials.
    - e. Installer further agrees that if installer fails to fulfill their obligation under this certification statement within 30 days notice of the complaint, Water-Repellent Manufacturer may proceed with the investigation and repairs and shall pay the entire cost, providing it wasn't the installer's responsibility.

## 1.9 MAINTENANCE

## A. Extra Materials:

1. Quantity: 10 percent of quantity needed to paint Project, but not to exceed one gallon, of each type and color of finish coat used.
2. Identification: At project completion, provide an itemized list complete with manufacturer, paint type and color coding for all colors used, and locations within the Project for Owner's later use in maintenance.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified paint coating product manufacturer, or approved equivalent:
  - a. PPG PAINTS.
    - 1) Composed of the following companies: AMERITONE PAINT, DECRATREND, DEFT, DEVOE COATINGS, DEVOE PAINT, FLOOD WOOD CARE, FULLER O'BRIEN, GLIDDEN, and SINCLAIR PAINT.
  - b. Also specified: GEMINI and MONOPOLE.
  - c. Acceptable alternative manufacturers:
    - 1) DUNN EDWARDS, KELLY MOORE PAINTS, SHERWIN WILLIAMS, BENJAMIN MOORE and VISTA PAINT. Submittals by these manufacturers, subject to specification requirements, must be in accordance with Section - SUBMITTAL PROCEDURES.
      - a) Paint material quality and systems shall be equal to numbers and systems listed in Paint Finish Schedule at the end of this section.
      - b) If submitted paint numbers differ from Darden Architects, Inc. Paint Equivalency List, additionally submit explanation of difference and certification letter from the installer attesting that the different product is equal to or better than specified; i.e. equivalent or better percentage of solids, system ODFT, and VOC compliant. Paint Equivalency List published by Darden Architects, Inc. is available only for this project at written request.
2. Specified water-borne Alkyltrialkoxo Silane water repellent product manufacturer, or approved equivalent:
  - a. EVONIK DEGUSSA CORPORATION.
3. Specified Graffiti coating manufacturer, or approved equivalent:
  - a. Sacrificial:
    - 1) VISUAL POLLUTION TECH, INC.
  - b. Non-sacrificial:
    - 1) BASF HYDROZO.
    - 2) EVONIK DEGUSSA CORPORATION.
    - 3) THIS STUFF WORKS - TSW

- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
1. Shop Primers or Coil-Coated Primers: It shall be assumed that all Shop Primed or Coil-Coated primed metals do not meet the requirements for primer material and mil thickness as defined herein. As such, all Shop Primed or Coil-Coated primed metals shall be field primed as indicated in the schedule.
- B. Material Quality: Provide manufacturer's best-quality coating material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. All materials used shall be lead and mercury free and shall have low VOC content to meet the applicable standards in the area where the Project is located.
  2. All paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes, sags, air entrapment, etc.
  3. All Water-Repellant Coatings shall comply with the following:
    - a. Provide Alkyltrialkoxo Silane combination with a ratio concentration and application procedure as recommended by the manufacturer with the ability to cover in one or more applications for a ten year warranty in accordance with the following substrates:
      - 1) Thin Brick.
      - 2) Concrete.
      - 3) Concrete Masonry Units
      - 4) Split-Faced Concrete Masonry Units.
    - b. Color: Clear.
    - c. Active Substance: Alkyltrialkoxo Silane.
    - d. Active Content: 100 percent.
    - e. Solvent: Water.
    - f. Flash Point (Concentrate): 93 degrees F.
    - g. Flash Point (Mixed): 200 degrees F.
    - h. Density: 7.77 lbs./gallon.
    - i. VOC (19:1): 50 g/liter (Maximum).
    - j. VOC (9:1): 100 g/liter (Maximum).
    - k. VOC (6:1): 200 g/liter (Maximum).
  4. All Bituminous Paint:
    - a. Shall comply with Cold-Applied Asphalt-Mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

## 2.3 MIXES

- A. Mixing and Tinting:
1. Unless otherwise specified herein or pre-approved, all paint shall be ready-mixed and pre-tinted at the factory. Re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and color and gloss uniformity.

2. Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
3. Where thinner is used, addition shall not exceed paint manufacturer's written recommendations.
4. Do not use kerosene or any such organic solvents to thin water-based paints.
5. Thin paint for spraying in strict accordance with paint manufacturer's written instructions. If directions are not on the container, obtain instructions in writing from the manufacturer and provide one copy of instructions to the Project Inspector.

## 2.4 FINISHES

### A. Finish Colors:

1. Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements as a minimum.
2. Determined by Architect prior to or as work progresses.
  - a. Colors to be selected from paint manufacturer's full color systems, including standard, premium and custom colors.
3. When deep or 'Ultra colors' are selected, submit to Architect proposed revision to specified system product numbers, according to manufacturer's written recommendations.
  - a. When deep or ultra colors are selected for use on walls or special color treatments such as graphics or many color changes are desired, the areas and extent of use will be clarified upon request of the Contractor.
4. Gloss standards, in accordance with MPI standards, using the ASTM D 523 "Test for Specular Gloss", are as follows:

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
G1	Matte or Flat Finish	0 to 5	10 max.
G2	Velvet Finish	0 to 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Low Sheen or Satin Finish	20 to 35	35 min.
G5	Semi-Gloss Finish	35 to 70	
G6	Gloss Finish	70 to 85	
G7	High-Gloss Finish	Greater than 85	

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### A. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affects the execution of work under this specification section.
  - a. Thoroughly examine (and test as required, if necessary) all conditions and surfaces to be painted and report in writing to the Contractor and the Architect any conditions or surfaces that will adversely affect the work of this section.
  - b. The Installer is responsible for verifying the compatibility of items primed by others and the finish coat or coats required by the Contract Documents. Should an incompatibility occur, the Installer (along with the manufacturer's technical



representative) will recommend compatible alternatives for the Architect's approval.

2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

#### A. Protection before Application:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
2. Removal of Hardware and Miscellaneous Items:
  - a. Coordinate the work with other trades so that they remove electrical outlet and switch plates, mechanical diffusers, escutcheons, registers, surface hardware, fittings, fastenings, and the like prior to starting work under this Section.
  - b. Store during painting work. Coordinate cleaning and reinstallation after painting work is finished.
  - c. Do not use solvent or cleaning agents detrimental to permanent finishes.
  - d. Remove doors before painting to paint bottom and top edges, and then re-hang.
3. Protect adjacent surfaces against damage from painting operations. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
  - a. Protective means include: Drop cloths, shields, masking templates, etc.
  - b. Exterior surfaces include: landscaping, walks, drives, adjacent building surfaces, glazing, aluminum surfaces, etc.
  - c. Interior surfaces include: rating and instruction labels on doors, frames, equipment, piping, etc.

#### B. Surface preparation:

1. General:
  - a. In accordance with MPI Standards.
  - b. Surfaces to be finished shall be clean, dry and free of dirt, passivators, oils, loose paint and any other contamination that would adversely affect adhesion, protective properties or appearance of the coating.
  - c. All oil, grease, dirt or other foreign matter shall be removed by washing with a solution of cleaner and water, rinse and allow to dry.
  - d. If efflorescence, alkali or glazed surfaces exist, neutralize with acid wash followed by thorough water rinsing.
    - 1) Protect all adjacent substrates or materials that could be affected by acid washing or water rinsing. Collect all washing & rinsing residue and dispose of away from structures.
2. Wood Substrates - (New and Repaint Surfaces):
  - a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
  - b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
  - c. Fill holes and other imperfections with putty or plastic wood to match natural finish before and after application of prime or seal coat.
  - d. Provide necessary extra treatment over knots, pitch pockets, sappy portions and other defects to produce a proper base for painting.
  - e. Sand down raised grain or rough surfaces.
  - f. Clean surfaces free of dust, soil and other foreign material.

3. Gypsum Board Substrates - (New and Repaint Surfaces):
  - a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
  - b. Clean surfaces of dirt, laitance, excess mortar and foreign matter.
  - c. Do all necessary minor sanding.
  - d. Fill minor cracks, scratches, holes and nail heads.
4. Plaster Substrates - (New and Repaint Surfaces):
  - a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
  - b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
  - c. Clean surfaces of dirt, laitance, excess mortar and foreign matter.
  - d. Neatly patch, flush and smooth, minor cracks, holes, pits and other imperfections in plaster or concrete surfaces.
5. Concrete Substrates - (New and Repaint Surfaces):
  - a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
  - b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
  - c. Clean surfaces of dirt, laitance, excess mortar and foreign matter.
  - d. Neatly patch, flush and smooth, minor cracks, holes, pits and other imperfections in plaster or concrete surfaces.
6. Metal Substrates - (New and Repaint Surfaces):
  - a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
  - b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
  - c. Shop Primed or Factory Primed Surfaces:
    - 1) Shop Primed or Factory Primed Surfaces are considered "un-primed" due to their mil thicknesses provided, and common incompatibility issues with specified coating system; and are suitable only for protection during transit (shipment and storage) until incorporated into the Project.
    - 2) Remove dust, oil and rust.
    - 3) Sand surface lightly.
    - 4) Touch up imperfections, scratches, surface damage, etc. with the appropriate primer.
    - 5) Field connection welds, soldered joints, burned and abraded portions shall be spot primed with the appropriate primer.
  - d. Coil-Coated Product Surfaces:
    - 1) Coil-Coated Product Surfaces are considered "un-primed" due to their mil thicknesses provided, and the common incompatibility issues with specified coating system; and are suitable only for protection during shipment and storage until incorporated into the Project.
    - 2) Remove dust, oil and rust.
    - 3) Touch up imperfections, scratches, surface damage, etc. with the appropriate primer.
    - 4) Field connection welds, burned and abraded portions shall be spot primed with the appropriate primer.
    - 5) Field apply manufacturer's written recommended primer coat over entire surface compatible with substrate finish and finish coats indicated on the paint schedule.
  - e. Un-primed Surfaces:
    - 1) Remove dust, rust, mill scale, grease and foreign matter by sand blasting or wire brushing.
    - 2) Surfaces to be smooth and ready to receive coatings.
  - f. Non-Ferrous Metal, Galvanized, Aluminum, and Copper Surfaces:

- 1) Metal Etch and Solvent Clean per SSPC-SP 1 or clean with TSP or other appropriate cleaner followed by thorough water rinsing.
  - 2) Brush Blast to standards of SSPC-SP 16, or if blasting is not feasible, sand thoroughly, wipe clean and apply a test patch for the coating specified.
  - 3) Allow system to cure at least one week, then test adhesion per ASTM D 3359 "Standard Test Methods for Measuring Adhesion by Tape Test."
7. Concrete Block Surfaces - (New and Repaint Surfaces):
- a. Interior Surfaces: MPI Interior Surface Preparation, Chapter 3, Section 3.
  - b. Exterior Surfaces: MPI Exterior Surface Preparation, Chapter 2, Section 3.
  - c. Clean and free of all dirt, dust, rust, oil and free from all foreign matter.
  - d. Test for moisture content.
    - 1) Do not coat if moisture is present.
    - 2) Concrete Blocks to be thoroughly dry and cured prior to coating.
  - e. Do not coat Masonry wall if joints are not properly pointed, has excessive mortar drippings cracked units or shows signs of excessive efflorescence.
    - 1) Notify Architect promptly through General Contractor.
    - 2) Do not coat until unsatisfactory and unacceptable Concrete Block surfaces are corrected suitable for coating.
  - f. Do not apply opaque finishes to Concrete Block with airless sprayer unless "backrolled."

### 3.3 APPLICATION

#### A. Standards:

1. In accordance with MPI Painting Manual.
2. In accordance with manufacturer's specifications.

#### B. Method:

1. Apply by brush, roller or spray in accordance with MPI Painting Manual and the coating manufacturer's written recommendations except where specified otherwise in Schedule of Paint Finishes.
2. Painting of doors by rollers shall only be allowed only if the applicator uses a 1/4 inch nap or less roller.

#### C. Coatings:

1. All coatings shall be applied without reduction except as specifically required by label directions, or required to be reduced by this Specification. In such cases, reduction shall be the minimum permitted and shall not exceed VOC limits.
2. Apply each coat evenly and allow each coat to dry prior to applying succeeding coats. Each coat to have enough consistency to conceal work to which it is applied.
  - a. Follow manufacturer's recommendations for recoat windows when using high performance coatings, epoxys, and urethanes.
3. Cut into a true line and leave smooth and clean without overlapping. Coat doors and windows in open position.
4. Sand finishes on smooth surfaces to assure proper adhesion of subsequent coats.
5. Tint each undercoat a lighter shade to facilitate identification of each coat, if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
6. Apply coating systems so as to obtain not less than the dry film mil thickness recommended by the manufacturer.
7. Sand metal work only as necessary to provide for the complete bonding of coats.

8. Project Inspector to inspect and approve each coat and operation before succeeding coats are applied.
9. Finish work to be free from runs, sags, defective application and improper workmanship.
10. Back prime all woodwork and casework coming in contact with plaster, masonry or concrete immediately upon delivery to project.
11. Post sign promptly following application of coatings.

### 3.4 FIELD QUALITY CONTROL

- A. All surfaces, preparation and paint applications shall be inspected by the Project Inspector.
- B. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection by the Project Inspector:
  1. Brush / Roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
  2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
  4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
  5. Damage and / or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- C. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
  1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
  2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
  3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
  4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- D. Painted surfaces rejected by the Project Inspector shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

### 3.5 CLEANING

- A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS and PROJECT CLOSEOUT.
- B. Remove all paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.
- C. Keep work area free from unnecessary accumulation of tools, equipment, surplus materials and debris.
- D. Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.
- E. Clean equipment and dispose of wash water / solvents as well as all other cleaning and protective materials (e.g., rags, drop cloths, masking papers, etc.), paints, thinners, paint

removers / strippers in accordance with the safety requirements of authorities having jurisdiction in the place where the Project is located.

- F. Protect and safeguard work of other trades.

### 3.6 PROTECTION

- A. Protection from Weather:
  - 1. Protect newly installed work from moisture for a period of time as recommended by the manufacturer after application.
- B. Protection from Traffic:
  - 1. Erect barriers or screens and post signs to warn of or limit or direct traffic away or around work area as required.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

### 3.7 SCHEDULES

- A. Refer to Exterior and Interior Finish Schedules on Drawings for applicable finishes used. This is a guide only and paint sub-contractor is responsible to check all drawings and be responsible for all paint work required to cover the complete painting and finishing of the interior and exterior including specialty items.
- B. It is the intent of the specifications and drawings to cover the complete painting and finishing of the Project whether or not it is specifically called for in the Specifications, Schedule of Paint Finishes, or indicated on the Drawings. Surfaces not specified in Paint Finishes Schedule shall be in accordance with manufacturer's written recommendations.
  - 1. Inform the Architect of any changes caused by stricter Air Quality Standards as part of the submittal process.
  - 2. Provide products compliant with Local Air Quality Control District requirements at the time of installation.
- C. Exception: When the Project involves remodel work, the scope of work is limited to the remodel area and adjacent existing substrates to minimize visible color incompatibility.
- D. Provide coating system minimum ODFT specified.
  - 1. Do not apply thicker coats than specified to achieve ODFT. Apply additional coats if necessary for uniform color.
- E. "Ultra Color" Note: A fourth and/or fifth coat may be required to achieve uniform chromatic hue without ghosting from undercoat or substrate.
  - 1. The Contractor shall consider all Metal Paint Finishes noted "Ultra-color" as requiring as many as five (5) total coats.

### 3.8 INTERIOR PAINT FINISHES:

- A. INTERIOR WOODWORK
  - 1. W-1 Flat Latex                      Minimum ODFT 4.2 MILS.
    - a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
    - b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
    - c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI
  - 2. W-2 Semi-Gloss Acrylic Non-Blocking Enamel    Minimum ODFT 4.0 MILS.

- a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
- b. 2nd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
- c. 3rd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
- 3. W-3 Gloss Waterborne Acrylic Non-Blocking Enamel Minimum ODFT 9.4 MILS.
  - a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
  - b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
  - c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
- 4. W-4 Semi-Transparent Resin Stain Minimum ODFT 1.9 MILS.
  - a. 1st Coat Resin Wiping Stain DEFT Int. Stain
  - b. 2nd Coat Clear Acrylic DEFT Clear Wood
- 5. W-5 Semi-Transparent Resin Stain Minimum ODFT 3.3 MILS.
  - a. 1st Coat Resin Wiping Stain DEFT Int. Stain
  - b. 2nd Coat Clear Acrylic DEFT Clear Wood
  - c. 3rd Coat Clear Acrylic DEFT Clear Wood
- 6. W-6 Stained and Water Clear Lacquer Minimum ODFT 3.8 MILS.
  - a. 1st Coat Resin Wiping Stain DEFT Int. Stain
  - b. 2nd Coat Lacq. Sanding Sealer DEFT WB Sanding Sealer
  - c. 3rd Coat Clear Acrylic DEFT WB 109/S
  - d. 4th Coat Clear Acrylic DEFT WB 109/S
- 7. W-7 Filled and Sealed Floor Finish Minimum ODFT 3.0 MILS.
  - a. 1st Coat Paste Filler As recommended by Flooring Manufacturer
  - b. 2nd Coat Satin Polyurethane DEFT 26
  - c. 3rd Coat Satin Polyurethane DEFT 26
- 8. W-8 Velvet Lacquered Finish Minimum ODFT 4.7 MILS.
  - a. 1st Coat Lacq. Sanding Sealer DEFT WB Sanding Sealer
  - b. 2nd Coat Clear Acrylic DEFT WB 109/S
  - c. 3rd Coat Clear Acrylic DEFT WB 109/S
  - d. 4th Coat Clear Acrylic DEFT WB 109/S

#### B. INTERIOR GYPSUM BOARD

- 1. DW-1 Flat Latex Minimum ODFT 4.2 MILS.
  - a. 1st Coat SPEEDHIDE ZERO (SPH-0) P/S 6-4900XI
  - b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
  - c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI
- 2. DW-2 Eggshell Acrylic Non-Blocking Enamel Minimum ODFT 4.0 MILS.
  - a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
  - b. 2nd Coat Eggshell 0 VOC (SPH-0) 6-4310XI
  - c. 3rd Coat Eggshell 0 VOC (SPH-0) 6-4310XI
- 3. DW-3 Gloss Acrylic Non-Blocking Enamel Minimum ODFT 9.4 MILS.
  - a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
  - b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
  - c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
- 4. DW-4 Gloss Epoxy Polyamide (Corrosion Resistant) Minimum ODFT 7.6 MILS.
  - a. 1st Coat Acrylic Primer SEAL GRIP 17-921
  - b. 2nd Coat Epoxy Gloss AQUAPON WB-EP 98E-1
  - c. 3rd Coat Epoxy Gloss AQUAPON WB-EP 98E-1

5. DW-4 WB Semi-Gloss Epoxy (Corrosion Resistant) Minimum ODFT 4.6 MILS.
    - a. 1st Coat Acrylic Primer SEAL GRIP 17-921
    - b. 2nd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510
    - c. 3rd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510
  6. DW-5 Semi-Gloss Acrylic Non-Blocking Enamel Minimum ODFT 4.0 MILS.
    - a. 1st Coat SPEEDHIDE ZERO (SPH-0) Primer 6-4900XI
    - b. 2nd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
    - c. 3rd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI
    - d. Note: This system was previous named "DW-2".
- C. INTERIOR CEMENT PLASTER, VENEER PLASTER OR GYPSUM PLASTER
1. P-1 Flat Latex Minimum ODFT 5.4 MILS.
    - a. 1st Coat Acrylic Primer-Sealer 4-603XI
    - b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
    - c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI
  2. P-2 Eggshell Acrylic Non-Blocking Enamel Minimum ODFT 5.6 MILS.
    - a. 1st Coat Acrylic Primer-Sealer 4-603XI
    - b. 2nd Coat Eggshell 0 VOC (SPH-0) 6-5310
    - c. 3rd Coat Eggshell 0 VOC (SPH-0) 6-5310
  3. P-3 Gloss Acrylic Non-Blocking Enamel Minimum ODFT 10.6 MILS.
    - a. 1st Coat Acrylic Primer-Sealer 4-603XI
    - b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
    - c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
  4. P-4 Gloss Epoxy Polyamide (Corrosion Resistant) Minimum ODFT 7.6 MILS.
    - a. 1st Coat Acrylic Primer SEAL GRIP 17-921
    - b. 2nd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series
    - c. 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series
  5. P-4 WB S/G Epoxy (Corrosion Resistant) Minimum ODFT 4.6 MILS.
    - a. 1st Coat Acrylic Primer SEAL GRIP 17-921
    - b. 2nd Coat WB Epoxy Semi-Gloss PITT-GLAZE 16-510
    - c. 3rd Coat WB Epoxy Semi-Gloss PITT-GLAZE 16-510
  6. P-5 Semi-Gloss Acrylic Non-Blocking Enamel Minimum ODFT 5.2 MILS.
    - a. 1st Coat Acrylic Primer-Sealer 4-603XI
    - b. 2nd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI / 6-5510
    - c. 3rd Coat Semi-Gloss 0 VOC (SPH-0) 6-4510XI / 6-5510
- D. INTERIOR CONCRETE OR CONCRETE MASONRY UNITS
1. CB-1 Clear Water Repellent Sealer
    - a. One Coat Alkyltrialkoxo Silane
      - 1) EVONIK DEGUSSA "Aqua-Trete®CONCENTRATE."
    - b. Follow manufacturer's recommended coverage rate and installation recommendations for type of substrate to be covered.
    - c. Provide manufacturer's 10 year warranty for Concrete Masonry Units and Split Faced Concrete Masonry Units.
  2. CB-2 Flat Latex - Fine Texture Minimum ODFT 9.9 MILS.
    - a. 1st Coat Acrylic Block Filler (SPH-0) 6 - 7

- 1) Omit at concrete surfaces.
- b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
- c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI
3. CB-3 Semi-Gloss Acrylic Enamel:
  - a. Concrete Masonry Units: Minimum ODFT 9.7 MILS.
    - 1) 1st Coat Acrylic Block Filler (SPEEDHIDE INT/EXT BLOCK FILL)
    - 2) 2nd Coat Flat 0 VOC (SPH-0) 6-4510XI
    - 3) 3rd Coat Flat 0 VOC (SPH-0) 6-4510XI
  - b. Concrete Surfaces: Minimum ODFT 4.6 MILS.
    - 1) 1st Coat Acrylic Primer-Sealer 3210
    - 2) 2nd Coat Flat 0 VOC (SPH-0) 6-4510XI
    - 3) 3rd Coat Flat 0 VOC (SPH-0) 6-4510XI
4. CB-4 Color High-Gloss Polyamide Epoxy:
  - a. Concrete Masonry Units: Minimum ODFT 15.6 MILS.
    - 1) 1st Coat W/B Epoxy Block Fill SPEEDHIDE HI-FILL INT/EXT BLOCK FILL
    - 2) 2nd Coat Acrylic Primer SEAL-GRIP 17-921
    - 3) 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1
    - 4) 4th Coat Epoxy Gloss AQUAPON WB EP 98E-1
  - b. Concrete Surfaces: Minimum ODFT 7.6 MILS.
    - 1) 1st Coat Epoxy Primer SEAL-GRIP 17-921
    - 2) 2nd Coat Epoxy Gloss AQUAPON WB EP 98E-1
    - 3) 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1
5. CB-4 Color WB Semi-Gloss Epoxy:
  - a. Concrete Masonry Units: Minimum ODFT 15.6 MILS.
    - 1) 1st Coat W/B Epoxy Block Fill SPEEDHIDE 6-15
    - 2) 2nd Coat Epoxy Primer SEAL-GRIP 17-921
    - 3) 3rd Coat Epoxy S/G PITT-GLAZE 16-510
    - 4) 4th Coat Epoxy S/G PITT-GLAZE 16-510 DFT 3.0 mils.
  - b. Concrete Surfaces: Minimum ODFT 7.6 MILS.
    - 1) 1st Coat Epoxy Primer SEAL-GRIP 17-921
    - 2) 2nd Coat Epoxy S/G PITT-GLAZE 16-510
    - 3) 3rd Coat Epoxy S/G PITT-GLAZE 16-510
6. CB-5 Clear High-Gloss Polyamide Epoxy Minimum ODFT 5.0 MILS.
  - a. 1st Coat Epoxy Gloss MONOPOLE Permashield 200
  - b. 2nd Coat Epoxy Gloss MONOPOLE Permashield 200

#### E. INTERIOR METALS

1. PRIMER NOTE: Metals that are shop primed shall be considered "un-primed" and shall be primed with appropriate primer and thicknesses listed below:
  - a. Ferrous Metal:
    - 1) PPG PITT-TECH PLUS 4020 "Red" Mult-Purp. Metal Primer DFT 3.0 mils.
  - b. Non-Ferrous Metal, Galvanized Metal or Aluminum:



- 1) PPG PITT-TECH PLUS 4020 "White" Mult-Purp. Metal Primer DFT 3.0 mils.
2. COIL-COATED PRODUCTS NOTE: Metal products primed with coil-coated products are to be assumed to be "un-primed" products and shall be additionally coated (or primed again) as follows:
  - a. Coil-Coated Products:
    - 1) Field apply manufacturer's recommended primer coat and mil thickness over entire surface compatible with substrate finish and finish coats indicated on paint schedule.
3. M-1 Flat Latex Minimum ODFT 5.8 MILS.
  - a. 1st Coat Primer See primer note above.
  - b. 2nd Coat Flat 0 VOC (SPH-0) 6-4110XI
  - c. 3rd Coat Flat 0 VOC (SPH-0) 6-4110XI
4. M-2 Semi-Gloss "Ultra Color" Industrial Acrylic Minimum ODFT 11.0 MILS.
  - a. 1st Coat Primer See primer note above.
  - b. 2nd Coat Acrylic Semi-Gloss PITT-TECH PLUS 90-1610
  - c. 3rd Coat Acrylic Semi-Gloss PITT-TECH PLUS 90-1610
5. M-3 Gloss "Ultra Color" Waterborne Acrylic Minimum ODFT 11.0 MILS.
  - a. 1st Coat Primer See primer note above.
  - b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
  - c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
6. M-4 Semi-Gloss Epoxy Polyamide Minimum ODFT 6.0 MILS.
  - a. 1st Coat Primer See primer note above.
  - b. 2nd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510
  - c. 3rd Coat Epoxy Semi-Gloss PITT-GLAZE 16-510
7. M-5 Gloss Epoxy Polyamide Minimum ODFT 4.6 MILS.
  - a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
  - b. 2nd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series
  - c. 3rd Coat Epoxy Gloss AQUAPON WB EP 98E-1 Series
8. M-5 Water Base S/G Epoxy (Corrosion Resistant) Minimum ODFT 7.6 MILS.
  - a. 1st Coat Acrylic Primer SEAL GRIP 17-921
  - b. 2nd Coat WB Epoxy S/G PITT-GLAZE 16-510
  - c. 3rd Coat WB Epoxy S/G PITT-GLAZE 16-510
9. M-6 Flat Waterborne Paint Minimum ODFT 4.4 MILS.
  - a. 1st Coat Flat Dry Fall Prime SUPER TECH 6-726XI
  - b. 2nd Coat Flat Dry Fall Finish SUPER TECH 6-726XI
10. M-7 Semi-Gloss Waterborne Paint Minimum ODFT 4.4 MILS.
  - a. 1st Coat S/G Dry Fall Primer SUPER TECH 6-724XI
  - b. 2nd Coat S/G Dry Fall Finish SUPER TECH 6-724XI
11. M-8 Satin Industrial Acrylic Minimum ODFT 11.0 MILS.
  - a. 1st Coat Primer See primer note above.
  - b. 2nd Coat Acrylic Satin PITT-TECH PLUS 90-1110
  - c. 3rd Coat Acrylic Satin PITT-TECH PLUS 90-1110

## F. INTERIOR ACOUSTICAL TILE

1. A-1 Matte Flat Vinyl Acrylic Minimum ODFT 1.3 MILS.
  - a. 1st Coat Flat Vinyl Acrylic PRO-EV 0-VOC 12-110

### 3.9 EXTERIOR PAINT FINISHES

#### A. EXTERIOR WOOD

1. EW-1 Flat 100 percent Acrylic Minimum ODFT 6.0 MILS.
  - a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
  - b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
  - c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
2. EW-2 Semi-Gloss 100 percent Acrylic Minimum ODFT 5.6 MILS.
  - a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
  - b. 2nd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
  - c. 3rd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
3. EW-3 100 percent Acrylic Resin (A/R) Stain Minimum ODFT 3.0 MILS.
  - a. 1st Coat 100 percent A/R Stain Coat FLOOD SWF
  - b. 2nd Coat 100 percent A/R Stain Coat FLOOD SWF

#### B. EXTERIOR SOFFIT BOARD

1. ESB-1 Lo-Sheen 100 % Acrylic Resin-Heavy Stipple Minimum ODFT 5.8 MILS.
  - a. 1st Coat Epoxy Primer SEAL-GRIP 17-921
  - b. 2nd Coat 100 percent Acrylic Satin SUNPROOF 76-Series
  - c. 3rd Coat 100 percent Acrylic Satin SUNPROOF 76-Series
  - d. \*Note: 2nd Coat to have medium size aggregate added to achieve heavy stipple texture.

#### C. EXTERIOR CEMENT PLASTER

1. EP-1 Flat 100 percent Acrylic Minimum ODFT 7.0 MILS.
  - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
  - b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
  - c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
2. EP-2 Semi-Gloss 100 percent Acrylic Minimum ODFT 6.6 MILS.
  - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
  - b. 2nd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
  - c. 3rd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
3. EP-3 Gloss Styrene Acrylic Minimum ODFT 5.6 MILS.
  - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
  - b. 2nd Coat Gloss ADVANTAGE 900 INT/EXT STYRENE ACRYLIC
  - c. 3rd Coat Gloss ADVANTAGE 900 INT/EXT STYRENE ACRYLIC
4. EP-4 Smooth Elastomeric, Lo Sheen Acrylic/Resin (A/R) Minimum ODFT 11.9 MILS.
  - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
  - b. 2nd Coat Smooth Elastomeric PITT-FLEX 4-110. Spray and Backroll.
  - c. 3rd Coat 100 percent Acrylic Resin Semi Gloss 76-Series
5. EP-5 Satin Elastomeric, S/G Acrylic/Resin (A/R) Minimum ODFT 11.8 MILS.
  - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
  - b. 2nd Coat Matte Flex Elastomeric PITT-FLEX 4-110

- 1) Spray and Backroll
- c. 3rd Coat 100 percent Acrylic semi-gloss SUNPROOF 78-Series
- 6. EP-6 Coarse Elastomeric, Satin Acrylic/Resin (A/R) Minimum ODFT 11.8 MILS.
  - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
  - b. 2nd Coat Elastomeric Finish 4-110. Spray and Backroll.
  - c. 3rd Coat 100 percent Acrylic Satin SUNPROOF 76-Series
- D. EXTERIOR CONCRETE OR CONCRETE MASONRY UNITS:
  - 1. ECB-1 Clear Water Repellent Sealer:
    - a. One Coat Alkyltrialkoxo Silane:
      - 1) EVONIK DEGUSSA "Aqua-Trete®CONCENTRATE."
    - b. Provide manufacturer's 10 year warranty for Concrete Masonry Units and Split Faced Concrete Masonry Units.
  - 2. ECB-2 Flat 100 percent Acrylic Minimum ODFT 11.5 MILS.
    - a. 1st Coat W/B Acrylic Block Filler SPEEDHIDE 6-7
      - 1) Omit at concrete surfaces
    - b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
    - c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
  - 3. ECB-3 Flat 100 percent Acrylic Minimum ODFT 5.5 MILS.
    - a. 1st Coat 100 percent Acrylic Primer-Sealer 4-603XI
    - b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
    - c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
- E. EXTERIOR METAL
  - 1. PRIMER NOTE: Metals shop primed shall be considered "un-primed" □ and shall be primed with appropriate primer and thicknesses listed below:
    - a. Ferrous Metal, Type 1 Typical:
      - 1) PITT TECH PLUS 4020 "Red" Multi-Purpose Metal Primer DFT 3.0 mils.
    - b. Ferrous Metal, Type 2 as specified in Specification Section – STEEL AND FABRICATIONS:
      - 1) AMERCOAT 68HS Reinforced Inorganic Zinc-Rich Urethane Metal Primer DFT 5.0 mils.
    - c. Ferrous Metal, Type 3 when Urethane is used as a finish:
      - 1) AMERLOCK 2VOC/400 VOC Epoxy Metal Primer DFT 6.0 mils.
    - d. Non-Ferrous Metal, Type 4 Galvanized Metal or Aluminum:
      - 1) PITT TECH PLUS "White" Multi- Purpose Metal Primer DFT 3.0 mils.
    - e. Non-Ferrous Metal, Type 5 Galvanized Metal or Aluminum, when Urethane is used as a finish.
      - 1) AMERLOCK 2VOC/400 VOC Epoxy Metal Primer DFT 6.0 mils.
  - 2. COIL-COATED PRODUCTS NOTE: Metal products primed with coil-coated products are to be assumed to be unprimed products and shall be re-primed as follows:
    - a. Coil-Coated Products:

- 1) Field apply manufacturer's recommended primer coat and mil thickness over entire surface compatible with substrate finish and finish coats indicated on paint schedule.
3. EM-1 Flat 100 percent Acrylic Minimum ODFT 7.4 MILS.
  - a. 1st Coat Primer See primer notes above.
  - b. 2nd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
  - c. 3rd Coat 100 percent Acrylic Flat SUNPROOF 72-Series
4. EM-2 Semi-Gloss "Ultra Color" 100 percent Acrylic Minimum ODFT 7.2 MILS.
  - a. 1st Coat Primer See primer notes above.
  - b. 2nd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
  - c. 3rd Coat 100 percent Acrylic Semi-Gloss SUNPROOF 78-Series
5. EM-3 Gloss "Ultra Color" 100 percent Acrylic Waterborne Minimum ODFT 11.0 MILS.
  - a. 1st Coat Primer See primer notes above.
  - b. 2nd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
  - c. 3rd Coat Gloss Acrylic PITT-TECH PLUS 90-1310
6. EM-4 Gloss "Ultra Color" Aliphatic Acrylic Urethane (A/A/U) Finish, Spray Applied, Deep Tone, Custom Color Minimum ODFT 16.0 MILS.
  - a. 1st Coat Primer See primer notes above.
  - b. 2nd Coat A/A/U Gloss Color AMERSHIELD VOC
  - c. 3rd Coat A/A/U Gloss Color AMERSHIELD VOC
7. EM-5 Gloss "Ultra Color" Aliphatic High Solids Finish, Spray Applied, Deep Tone, Custom Color with clear protective coats Minimum ODFT 18.0 MILS.
  - a. 1st Coat Primer See primer notes above
  - b. 2nd Coat A/A/U Gloss Color AMERSHIELD VOC
  - c. 3rd Coat A/A/U Gloss Color AMERSHIELD VOC
  - d. 4th Coat A/A/U Gloss Clear AMERSHIELD VOC
  - e. 5th Coat A/A/U Gloss Clear AMERSHIELD VOC
8. EM-6 Semi-Gloss "Ultra Color" Aliphatic Urethane (A/U) Finish, Spray Applied, Deep Tone, Custom Color Finish Minimum ODFT 20.0 MILS.
  - a. 1st Coat Primer See primer notes above.
  - b. 2nd Coat A/A/U Semi-Gloss AMERCOAT 240
  - c. 3rd Coat A/A/U Semi-Gloss AMERSHIELD VOC

### 3.10 SPECIALTY PAINT FINISHES:

#### A. PROVIDE SPECIALTY PAINT FINISHES AS SHOWN OR AS FOLLOWS:

1. **Finish No. X-1:** Minimum ODFT 15.0 MILS.
  - a. Lines on Concrete or Asphaltic Concrete Paving Exit and Entrance Signs - 10" width lines, maximum. Reflectorize as required.
  - b. PPG ZoneLine
2. **Finish No. X-2:** Minimum ODFT 15.0 MILS.
  - a. Lines on Walk Top. Colors as selected by Architect.
    - 1) PPG ZoneLine
3. **Finish No. X-3:** Minimum ODFT 2.2 MILS.
  - a. Space above Vents or Grilles.

- b. 1st Coat 100 percent Acrylic Flat Black 72-Series
- 4. **Finish No. X-4:** Minimum ODFT 7.0 MILS.
  - a. Piping Black Steel or Cast Iron.
  - b. 1st Coat Multi-Purpose Metal Primer: PITT TECH PLUS 4020 "Red"
  - c. 2nd Coat Acrylic Gloss Finish 2406G
- 5. **Finish No. X-5:** Minimum ODFT 7.0 MILS.
  - a. Piping Galvanized.
  - b. 1st Coat General Purpose Metal Primer. PITT TECH PLUS 4020 "White"
  - c. 2nd Coat Gloss Enamel Finish: PITT TECH PLUS 90-1310
- 6. **Finish No. X-6:** Minimum ODFT 11.0 MILS.
  - a. Machinery and Equipment (Coil Coated Products):
  - b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White"
  - c. 2nd Coat Gloss Enamel PITT TECH PLUS 90-1310
  - d. 3rd Coat Gloss Enamel PITT TECH PLUS 90-1310
- 7. **Finish No. X-7:** Minimum ODFT 7.0 MILS.
  - a. Sheet Metal Ducts:
  - b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White"
  - c. 2nd Coat 100 percent Acrylic Flat: PITT TECH PLUS 90-1310
- 8. **Finish No. X-8:** Minimum ODFT 7.0 MILS.
  - a. Fire Hydrants:
  - b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White"
  - c. 2nd Coat 100 percent Acrylic Flat: PITT TECH PLUS 90-1310
- 9. **Finish No. X-9:** Minimum ODFT 7.4 MILS.
  - a. Following items listed will receive Finish No. X-9 (including, but not limited to), Louvers, Grilles, or Access Panels.
  - b. 1st Coat General Purpose Metal Primer: PITT TECH PLUS 4020 "White"
  - c. 2nd Coat 100 percent Acrylic Flat SUNPROOF FLAT 72-Series
  - d. 3rd Coat 100 percent Acrylic Flat SUNPROOF FLAT 72-Series
- 10. **Finish No. X-10:** Minimum ODFT 1.9 MILS.
  - a. Striping under Acoustical Board Surrounding Structure:
  - b. 1st Coat 100 percent Acrylic Flat Black SUNPROOF FLAT 72-Series
- 11. **Finish No. X-11:** Minimum ODFT 2.2 MILS.
  - a. Acoustical Board and Exposed Striping and Structural:
  - b. 1st Coat 100 percent Acrylic Flat Black SUNPROOF FLAT 72-Series
- 12. **Finish No. X-12:**
  - a. Minimum ODFT as recommended by graffiti coating manufacturer.
  - b. Graffiti Coating, non-toxic, liquid, sacrificial wax-based Coating:
  - c. 1st Coat Graffiti Coating:
    - 1) Graffiti-Pruf by VISUAL POLLUTION TECH, INC.
  - d. 2nd Coat Graffiti Coating:
    - 1) Only if recommended by manufacturer for substrate material type.
    - 2) Graffiti-Pruf by VISUAL POLLUTION TECH, INC.
- 13. **Finish No. X-13 (NOT APPLICABLE).**
- 14. **Finish No. X-14 (NOT APPLICABLE).**

**15. Finish No. X-15:**

- a. Clear Graffiti Coating, non-toxic, liquid, multi-polymer, non-sacrificial, single component sealer by BASF, or approved equivalent: One Coat
  - 1) **NOTE #1:** Test a small area of the existing substrate in an out-of-the-way spot, as determined by the Architect, for compatibility. Inform the Architect if an incompatibility is found for further direction. If found to be compatible, proceed as follows:
- b. 1st Coat Clear, flat matte coat TAGGUARD by BASF.
  - 1) **NOTE #2:** Follow manufacturer's recommendations for proper installation over various substrates. Applicator must be certified by the manufacturer as an approved applicator for this product over various substrate materials. Protect at least 24 hours minimum the treated surface until manufacturer's recommended curing time has been achieved against graffiti.
- 2) REMOVAL COAT TAGGUARD Cleaner.
  - 3) **NOTE #3:** Provide remover in small containers equal to 8-16 oz. containers of material for the Owner's use. Instruct the designated representative of the Owner as to proper application of the remover, and all procedures for removing graffiti.

**16. Finish No. X-16:** Non-sacrificial, aqueous, silane chemistry, ready-to-use, zero VOC high performance anti-graffiti treatment for masonry, concrete and natural stone, dries clear and will not yellow.

- a. Follow manufacturer's printed recommendations prior to use.
- b. Do not apply to wet surfaces. If surface is wet, let dry for a minimum of 24 hours prior to application. Do not use if temperature is below 40 degrees F or above 100 degrees F.
- c. Protect non-porous surface substrates from overspray. Always do a test patch to confirm the treatment before using to determine if there are any problems prior to full coverage of the porous surfaces.
- d. Concrete shall be allowed to cure a minimum of 28 days. All pointing or re-pointing shall be completed and allowed to cure for at least 3 days prior to coverage. All patching materials, caulking, sealing materials and traffic paint shall be fully cured before application.
- e. 1st Coat Clear, flat matte coat PROTECTOSIL ANTIGRAFFITI.
  - 1) 175 to 250 sq. ft. per gallon, diluted by 14 parts of water, using a 1" nap roller.
- f. 2nd Coat Clear, flat matte coat PROTECTOSIL ANTIGRAFFITI.
  - 1) 175 to 250 sq. ft. per gallon, un-diluted, using a 1" nap roller.
- g. 3rd Coat Clear, flat matte coat PROTECTOSIL ANTIGRAFFITI.
  - 1) 175 to 250 sq. ft. per gallon, un-diluted, using a 1" nap roller.
  - 2) 3rd Coat shall always be figured in as part of the Base Bid. 3rd Coat may be deleted if it is determined by all concerned that the two coats were sufficient to protect the surfaces. If not needed, then figure on a credit back to the Owner.
  - 3) Most graffiti removal can be achieved with standard non-hazardous cleaners and low-pressure waterblasting. Contact manufacturer for stubborn markings for removal.

17. **Finish No. X-17:** Non-sacrificial, 100 percent active silane treatment with oleophobic additive, clear penetrating breathable VOC Compliant (400 g/L) surface treatment for use on concrete, brick masonry, concrete masonry units and natural stone.
  - a. For flat (horizontal) concrete walks.
    - 1) Manufacturer's printed recommendations for rate of coverage, and type of application method to protect porous surfaces from graffiti and for ease of walk-way clean-up.
    - 2) Follow manufacturer's printed recommendations prior to use.
    - 3) Do not apply to wet surfaces. If surface is wet, let dry for a minimum of 24 hours prior to application. Do not use if temperature is below 40 degrees F or above 100 degrees F.
    - 4) Protect non-porous surface substrates from overspray. Always do a test patch to confirm the treatment before using to determine if there are any problems prior to full coverage of the porous surfaces.
    - 5) Concrete surfaces shall be allowed to cure a minimum of 28 days. All pointing or re-pointing shall be completed and allowed to cure for at least 3 days prior to coverage. All patching materials, caulking, sealing materials and paint shall be fully cured before application.
  - b. 1st Coat Clear, flat matte coat      PROTECTOSIL BHN PLUS.
18. **Finish No. X-18:** Non-sacrificial, Graffiti Coating, non-toxic, liquid, semi-permanent, acrylic based Coating - Minimum ODFT as recommended by graffiti coating manufacturer.
  - a. For application on sealed surface, including but not limited to CMU scheduled to be sealed, verify compatibility with sealer manufacturer prior to application of Sealer.
    - 1) Only if recommended by manufacturer for substrate material type.
    - 2) For application on natural porous surface, thin first coat with 40 percent water. All other coats shall be full strength.
  - b. 1st Coat Graffiti Coating    TSW4.
  - c. 2nd Coat Graffiti Coating    TSW4.
  - d. 3rd Coat Graffiti Coating    TSW4.
  - e. 4th Coat Graffiti Coating    TSW4.
  - f. Provide Manufacturer's recommended TSW2G Graffiti Removal Kit.
19. **Finish No. X-19:** Intumescent Paint - Minimum ODFT per fire rating required.
  - a. Primer: Per manufacturer's Written Recommendations, ODFT as required.
  - b. 1st Coat Water Based Polymer, ISOLATEK INTERNATIONAL "CAFECO Spray Film WB3."
  - c. 2nd Coat As required if needed - no greater than 62 mils per coat.
  - d. 3rd Coat As required if needed - no greater than 62 mils per coat.
  - e. 4th Coat Premium Exterior Latex Semi-Gloss GL68XX in thickness as recommended by manufacturer, and in color as selected by the Architect.
20. **Finish No. X-20:** Pool Paint High Gloss Epoxy - Minimum ODFT Approximately 3.6 mils.
  - a. Primer: RAMUC "Clean and Prep Solution" per manufacturer's Written Recommendations
  - b. 1st Coat                      Pool Paint by RAMUC
  - c. Finish Coat                Pool Paint by RAMUC

END OF SECTION





SECTION 10 05 00 – MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provision for and installation of specialty and built-in items required for this Work as indicated on the Drawings.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 4. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- B. Shop Drawings:
  - 1. Submit Shop Drawings and catalog cuts to the architect showing all details of installation and assembly and all requirements for work by other trades.
- C. Product Data:
  - 1. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.

1.3 REGULATORY REQUIREMENTS

- A. In accordance with Specification Section - REGULATORY REQUIREMENTS.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Storage and protection:
  - 1. Use all means necessary to protect all specialty items before, during and after installation and to protect the installed work and materials of all other trades.
- B. Replacements:
  - 1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.5 PROJECT CONDITIONS

- A. Existing Conditions:
  - 1. Surface Conditions:
    - a. Coordination: Coordinate with all other trades as required to ensure proper and adequate provision in framing and wall finish for the installation of the selected specialties in the locations required.
  - 2. Inspection:
    - a. Prior to Installation, inspect all specific locations and verify that all necessary provisions have been made.
    - b. In the event of discrepancy, immediately notify the Architect.
    - c. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

1.6 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty: 1 Year.
  - 1. In accordance with manufacturer's written standard warranty.
- C. Installer's Warranty: 1 Year.

1. In accordance with the terms of the Specification Section – WARRANTIES.

## PART 2 - PRODUCTS

NOT APPLICABLE

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all specialty items where indicated on the Drawings and in full accordance with all pertinent regulations and the manufacturer's written recommendations, anchoring all components firmly in place for long life under hard use, and in accordance with IR (Interpretation of Regulations, "Division of the State Architect") Manual.

### 3.2 ADJUSTING

- A. Upon completion of the installation, and as a condition of its acceptance, visually inspect the entire work of this Section, adjust all components for proper alignment and use, and touch up all abrasions and scratches to make them completely invisible.

### 3.3 SCHEDULES OF WINDOW COVERING SPECIALTIES

#### A. Window Film

1. Furnish and install as indicated on the drawings 3M Fasara Glass Finishes as manufactured by 3M or approved equivalent
2. Type 1:
  - a. Window Film is to be a combination of the two following products
    - 1) Aerina (SH2FGAR)
      - a) Film Type: Polyester
      - b) Width: 50"
      - c) Visible Light Reflectance: 13%
      - d) Visible Light Transmittance: 79%
    - 2) Cielo (SH2FGCE)
      - a) Pattern Scale: Very Small circles, less than 1/16 in diameter
      - b) Width: 50"
      - c) Adhesive Type: Pressure Sensitive
      - d) Film Type: Polyester
      - e) Visible Light Reflectance: 26%
      - f) Visible Light Transmittance: 56%
  - b. Refer to drawings for location and direction of gradation.
3. Type 2:
  - a. Cielo (SH2FGCE)
    - 1) Pattern Scale: Very Small circles, less than 1/16 in diameter
    - 2) Width: 50"
    - 3) Adhesive Type: Pressure Sensitive
    - 4) Film Type: Polyester
    - 5) Visible Light Reflectance: 26%
    - 6) Visible Light Transmittance: 56%
4. Install per manufacturer's written instructions.

## SECTION 10 11 00 – VISUAL DISPLAY BOARDS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to furnish and install Visual display boards and Tackboards, Accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 09 24 00 CEMENT PLASTER
  - 5. 09 29 00 GYPSUM BOARD
  - 6. 09 72 00 WALL COVERINGS
  - 7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Samples:
    - a. Submit one sample each of Manufacturer's standard finish colors (including standard, premium and custom colors).

## 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. In accordance with Specification Section REGULATORY REQUIREMENTS, and the following:
    - a. AIES American and Illuminating Engineering Society.

## 1.4 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period One (1) Year.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process

due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified Liquid Marker Board Panel product manufacturers:
  - a. EGAN VISUAL "Dimension Steele" - Model #DM-96-48-WH.
  - b. EGAN VISUAL Marker Tray ACD.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES

## 2.2 MATERIALS

- A. Liquid Marker Board Panels ("Dimension Steele"):
  1. "EVS" surface, steel substrate, dry erase and projection capable, and can accept standard magnetic accessories, with a White Edge, with mounting cleats included.
    - a. Provide "Flush Finish" for Left or Right End Panels.
    - b. Provide standard two (2) assorted color Dry-Erase Markers and one (1) "EganCloth".
  2. Size: 96" w x 48" h x 1" d, with White Edges - all board edges shall hover 3" off the wall.
  3. Orientation of the installed board panel: As indicated on the drawings.
  4. Accessories:
    - a. Magnetic Marker Tray: One for each Board.

## 2.3 FINISHES

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
- B. Coordinate with other sections for metal or wood backing.
  1. Contractor to coordinate all blocking required for sizes indicated on Drawings prior to enclosing stud cavities.
- C. Install boards top and bottom with Cleat and Wall Mount Assembly in accordance with the Manufacturer's written instructions.

## 3.2 ADJUSTING

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

## 3.3 CLEANING

- A. Clean units in accordance with the manufacturer's written instructions.

END OF SECTION

## SECTION 10 14 00 – IDENTIFYING DEVICES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Identifying Devices Plastic Signs, Acrylic Signs and Decals, materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 08 11 00 METAL DOORS AND FRAMES
  - 5. 08 80 00 GLASS
  - 6. 09 24 00 CEMENT PLASTER
  - 7. 09 29 00 GYPSUM BOARD
  - 8. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 9. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 DEFINITIONS

- C. Definitions pertaining to signage are as follows:
  - 1. Characters Shall mean all letters, numbers, symbols or pictograms.

## 1.3 SYSTEM DESCRIPTION

- D. Design Requirements for Tactile Signage:
  - 1. Characters and Graphics:
    - a. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background, either light characters on a dark background or dark characters on a light background – CBC Section 11B-703.5.1, 11B-703.6.2, and 11B-703.7.1.
    - b. Character Type: Characters on signs shall be raised 1/32 inch (0.794 mm) minimum and letters and numbers shall be sans serif uppercase characters accompanied by contracted (Grade 2) Braille complying with CBC Section 11B-703.3 and Table 11B-703.3.1.
    - c. Character Size: Raised characters (letters and numbers) shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high.
    - d. Pictorial symbol signs (pictograms): Pictorial symbol signs (pictograms) shall be accompanied by the verbal description placed directly below the pictogram. the outside dimension of the pictogram field shall be a minimum of 6 inches (152 mm) in height.
    - e. Character Placement: Characters and Braille shall be in a horizontal format. Braille shall be placed a minimum of 3/8 inch (9.5 mm) and a maximum of 1/2 inch (12.7 mm) directly below the tactile characters; flush left or centered. When tactile text is multilined, all Braille shall be placed together below all lines of tactile text.
    - f. Proportions: Raised characters on signs shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase letter "I." Stroke thickness of the uppercase "I" shall be 15 percent maximum of the height of the character.
      - 1) For Braille Text, capitalization shall conform to CBC Section 11B-703.3.1.

2. Braille:
  - a. California Contracted Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Braille shall accompany all raised characters – CBC Section 11B-703.3 and Table 11B-703.3.1.
    - 1) Dots shall be rounded or domed.
    - 2) Below measured as a minimum in inches and maximum in inches:
    - 3) Dot Base Diameter: 0.059 (1.5 mm) to 0.063 (1.6 mm).
    - 4) Distance between two dots in the same cell (measured center-to-center): 0.100 (2.5 mm).
    - 5) Distance between corresponding dots in adjacent cells (measured center-to-center): 0.300 (7.6 mm).
    - 6) Dot Height: 0.025 (0.6 mm) to 0.037 (0.9 mm).
    - 7) Distance between corresponding dots from one cell directly below:
      - a) 0.395 (10 mm) to 0.400 (10.2 mm).
  3. Signs shall be installed on the wall adjacent to the latch side of the door.
    - a. Where there is no space on the latch side, including at double leaf doors, signs shall be placed on the nearest adjacent wall, preferably on the right.
    - b. Mounting height shall be as indicated in details on the drawings and in compliance with 11B-703.4.1 and 11B-703.4.2.
  4. Inspection: Signage shall be field inspected after installation per CBC 11B-703.1.1.2.
- E. Performance Requirements: It is the intention of this specification section and the drawings to form a guide for a complete, operable system signage system that is compliant with State and Federal Accessibility Regulations. Any items not specifically noted but necessary for a complete, operable and accessible system shall be provided under this section.

#### 1.4 SUBMITTALS

- F. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  1. Product Data.
    - a. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect within thirty days of receipt of the NOTICE TO PROCEED.
      - 1) Provide actual 2-inch x 2-inch sample colors and patterns available from the manufacturers for color selection.
  2. Shop Drawings.
    - a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work, including accessibility dimensions for mounting heights.
    - b. Submit drawings indicating Room numbers shown on the Contract Documents coordinated with Owner's Room Numbers.
  3. Samples.
    - a. Provide actual 2-inch x 2-inch sample of each sign type specified.
  4. Quality Assurance/Control Submittals:
    - a. Certificates:
      - 1) Submit four (4) copies of certificates.
      - 2) Upon completion of the installation, submit a Certificate from the Contractor (on the Contractor's Letterhead) and co-endorsed by the manufacturer/supplier, sub-contractor/installer that the signage supplied for this project requiring braille complies with the California Contracted Grade 2 Braille and the CBC Section 11B-703.3.

- a) Those attesting to the compliance certificate above shall also acknowledge that they are aware of the Submission Under Penalty Of Perjury per California Government Code Section 12650, et seq, pertaining to false claims, and further know and understand that submission of certification of a false claim may lead to fines, imprisonment and/or other severe legal consequences.
- b. Manufacturer's Instructions:
  - 1) Submit three (3) copies of manufacturer's instructions.
- 5. Closeout Submittals in accordance with the following:
  - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
  - b. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
  - c. Warranty in accordance with Specification Section - WARRANTIES and this section.
- 1.5 QUALITY ASSURANCE
  - G. Qualifications:
    - 1. Installer Qualifications:
      - a. Engage an experienced Installer who has been approved by the manufacturer.
    - 2. Manufacturer's/Supplier's Qualifications:
      - a. Firm's experienced in successfully producing/supplying products similar to those indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
  - H. Regulatory Requirements:
    - 1. In accordance with Specification Section - Regulatory Requirements, and the following:
      - a. ADA Americans with Disabilities Act of 1990.
      - b. CBC California Building Code - California Contracted Grade 2 Braille when required.
    - 2. Inspection: Tactile signs shall be field inspected for compliance after installation (11B-703.1.1.2).
- 1.6 DELIVERY, STORAGE, AND HANDLING
  - I. Packing, shipping, handling, and unloading:
    - 1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
  - J. Acceptance at Site:
    - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
    - 2. Damaged products will not be accepted.
  - K. Storage and protection:
    - 1. Products shall be stored in a dry, protected area.
    - 2. Products shall be stored in locked storage building.
- 1.7 WARRANTY
  - L. Contractor's General Warranty:
    - 1. In accordance with Specification Section - WARRANTIES.
  - M. Manufacturer's Warranty:
    - 1. In accordance with manufacturer's written standard warranty:
      - a. Warranty Period One (1) Year.
  - N. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
  - a. Warranty period One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- O. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  1. Plastic Signs:
    - a. MOHAWK SIGN SYSTEMS.
    - b. Acceptable alternative manufacturer:
      - 1) BEST MANUFACTURING COMPANY.
  2. Acrylic Signs:
    - a. SIGNS OF SUCCESS, INC.
  3. Decals:
    - a. SETON NAME PLATE COMPANY.
- P. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

### 2.2 MATERIALS

- Q. Plastic Signs:
  1. Interior / Exterior:
    - a. MP (Melamine Plastic) both sides with contrasting phenolic resin core color. The MP shall be scratch resistant, non-static, fire retardant, washable melamine surface laminate with a non-glare surface with artwork and graphics carved into the face surface.
    - b. Performance Requirements:
      - 1) Weight: 1 lb./sq. Ft.
      - 2) Maximum Continuous Operating Temperature: -225 degrees F.
      - 3) Flexural Strength Flat: 25,000 psi.
      - 4) Tensile Strength: 22,000 psi.
      - 5) Compressive Strength Flat: 47,000 psi.
      - 6) Shear Strength: 16,800 psi.
      - 7) Dielectric Strength Short Time: 330 Volts/Mil.
        - a) Per ASTM D 229 "Sheet Plate Electrical Insulation Testing Equipment / Test Resources."
      - 8) NEMA rating: "Self-extinguishing."
    - c. Mylar, Photopolymers and Polymer Materials are not allowed.
    - d. "Sand Carved" MP plates (including phenolic core):
      - 1) Characters and Pictograms/Symbols:
        - a) Style: Tactile Helvetica Regular upper case.
        - b) Tactile: Raised 1/32" from sign face.
        - c) Braille: California Contracted Grade 2 located below characters:



- d) Style: Framed.
- e) Corners: Square.
- 2) Thickness: Approximately 1/8 inch thick.
- e. Frame and back-up (mounting) plates:
  - 1) Interior Plastic Frames and back-up plates:
    - a) High Impact Plastic Styrene frames.
    - b) Back-up plates shall be manufacturer's standard 1/8" thick melamine plastic laminate, suitable for interior use only and mechanical attachment to substrates.
    - c) Corner Style: Square.
    - d) Size: 1/2" deep x 1/8" thick walls.
    - e) Reveal: 3/32", black color.
  - 2) Aluminum Frames and back-up plates:
    - a) Extruded aluminum angle.
    - b) Back-up plates shall be manufacturer's standard 1/8" thick MP Plates suitable for exterior [**and interior**] use, and mechanical attachment to substrates.
    - c) Corner Style: Square.
    - d) Size: 1/2" deep x 1/16" thick walls.
    - e) Reveal: 3/32", black color.

R. Acrylic Signs:

- 1. Frameless, Profile Material bonded to Substrate Backup Material.
  - a. All signs shall be made of exterior acrylic materials regardless of location (exterior or interior) within the Project.
  - b. Profile Material:
    - 1) GRAVO-TAC "Exterior," modified acrylic material, 1-ply, 1/32 inch, matte finish, integral color as selected by the Architect.
  - c. Substrate Material:
    - 1) 1/4 inch clear cast acrylic backup sheet.
    - 2) Aluminum Frames and back-up plates:
      - a) Extruded aluminum angle.
      - b) Back-up plates shall be manufacturer's standard 1/8" thick aluminum Plates suitable for exterior [**and interior**] use, and mechanical attachment to substrates.
      - c) Corner Style: Square.
      - d) Size: 1/2" deep x 1/16" thick walls.
      - e) Reveal: 3/32", black color.

S. Decals:

- 1. Provide outdoor grade permanent vinyl material with die cut graphics, characters and self-adhesive back for bonding to clean, smooth surfaces.

## 2.3 ACCESSORIES

T. Fasteners:

- 1. Concealed Attachment: Provide appropriate flathead countersunk stainless steel screws for the substrate backing in which the sign is to be applied.
- 2. Adhesive: "Silastic Adhesive."

3. Foam Tape: SCOTCH MOUNT FOAM TAPE.

## 2.4 FABRICATION

### U. Shop Assembly:

1. Braille Compliance:
  - a. See Part 1 of this specification – SYSTEM DESCRIPTION, and comply with the "Design Requirements for Tactile Signage" □ that requires California Contracted Grade 2 Braille.
2. Plastic Signs:
  - a. Fabricate the plastic signs and backing plates, and then "Sand Carve" the MP plates in accordance with the manufacturer's recommendations and as indicated. Comply with ADA requirement for symbols and California Contracted Grade 2 Braille characters when required, and finish in accordance to the specifications. All components of the signage system shall be ready to install in the field.
3. Acrylic Signs:
  - a. Manufacturer's standard Profile Material, computer engineered, adhesive backed, raised graphics, complying with the latest CBC and ADA Accessibility Chapters and Sections, and ANSI A 117.1.
    - 1) Pictograms: All symbols shall match as closely as possible the published "International" symbols. Other interpretations will not be deemed acceptable. All symbols shall be approved prior to fabrication.
    - 2) Do not exceed the depth of profiling as recommended by the manufacturer for the thickness of the material to be profiled.

## 2.5 FINISHES

### V. Plastic Signs:

1. Finish: Non-glare, face and core as selected by the Architect from the manufacturer's full color line, including any custom colors form complying with the requirements for contrasting colors of field to Symbols and Braille Text.
2. Allow for two color application without the frame – one color for the field, top and bottom rails, and one color for the characters.

### W. Acrylic Signs:

1. Finish: Non-glare, face and core as selected by the Architect from the manufacturer's full color line, including any custom colors complying with the requirements for contrasting colors of field to Symbols and Braille Text.
2. Allow for two-color application – one color for the field, and one color for the characters.

### X. Decals:

1. Integral non-glare finish from outdoor vinyl and die cut vinyl graphics, characters, in contrasting colors as selected by the Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

#### Y. Site verification of conditions:

1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

#### Z. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work specified under this specification section.
2. Contractor to provide internal wall blocking for all attached identifying devices.

#### AA. Protection:

1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

#### BB. Surface preparation:

1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

### 3.3 INSTALLATION

#### CC. General:

1. In accordance with manufacturer's written instruction and recommendations unless specifically noted otherwise.
2. In accordance with approved Submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

#### DD. Layout:

1. Lines of all signs shall be straight and true.
2. Set plumb, level, and square.
3. Temporary positioning with foam tape.

#### EE. Plastic Signs:

1. "Blind" screw the back-up plate with four (4) flathead countersunk screws (minimum) so as not to interfere with face plate. Tape attachment is not allowed.
2. Anchor face plate to back-up plate with Silastic Adhesive for permanent attachment.
3. Seal all exposed edges at exterior conditions with compatible sealant, same color as sign back-up plate.

#### FF. Acrylic Signs:

1. "Blind" screw the back-up plate with four (4) flathead countersunk screws (minimum) so as not to interfere with face plate. Tape attachment is not allowed.
2. Anchor face plate to back-up plate with Silastic Adhesive for permanent attachment.
  - a. Tape attachment is not allowed.
3. Seal all exposed edges at exterior conditions with compatible sealant, same color as sign substrate backup plate.

#### GG. Mounting Conditions:

1. .
2. Wood Stud Framed Wall: Provide solid wood backing, attached to studs, adequate for fastening at all corners of sign.
3. Glass: Provide "Silastic Adhesive" for permanent attachment of back-up plate. Provide blank plate of same material and size as the sign itself. Place on opposite side of glass and aligned with sign. Color as selected by the Architect.
4. Door: Fasten to door with tamper resistant flathead countersunk screws, minimum three (3) stainless steel screws with grommet finish washers per sign.

### 3.4 FIELD QUALITY CONTROL

#### HH. Site Tests:

1. As required by Regulatory Requirements.

## 3.5 CLEANING

## II. Clean in accordance with Specification Sections - TEMPORARY FACILITIES AND CONTROLS and PROJECT CLOSEOUT.

1. Leave area level and free of any ruts or debris. Appearance of earth surface shall be equal to or better than adjacent undisturbed surfaces.
2. Clean any soiled surfaces at the end of each day, minimum.
3. Finish shall be clean and ready for the application of any additional finishes.
4. In accordance with manufacturer's written instructions and recommendations.

## 3.6 PROTECTION

## JJ. Protection from traffic:

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

## 3.7 SCHEDULES

## KK. General:

1. All signs with text shall have California Contracted Grade 2 Braille unless otherwise noted.
2. Refer to Plumbing drawings for number and approximate location for "Gas Valve" signs. Signs shall be mounted +2" above Finished Floor.
3. Refer to drawings for various backing requirements.

## LL. Sign Material:

1. EM = Exterior Metal.
2. IM = Interior Metal.
3. EP = Exterior Plastic.
4. IP = Interior Plastic.
5. A = Acrylic
6. D = Decal.

## MM. Mounting Condition:

1. 1 = Metal Stud Framed Wall.
2. 2 = Wood Stud Framed Wall.
3. 3 = Concrete or Concrete Masonry.
4. 4 = Glass.
5. 5 = Door Mounted.

## NN. Sign Types:

1. Sign Type 1 - Accessibility Entrance:
  - a. 7"H x 7" L nominal square shape.
    - 1) 6" high non-Tactile International Symbol of Accessibility required.
    - 2) No Text or Braille required.
2. Sign Type 2 - Toilet Room:
  - a. 3.5" H x 7" L nominal rectangular shape.
    - 1) 3/4" high Tactile Text.
      - a) "XXXXXX" and "RESTROOM".
    - 2) Braille required.
  - b. 12" diameter nominal circular shape ("FEMALE").
    - 1) No Text or Braille required.
  - c. Equilateral triangle shape edges 12" L with vertex upward ("MALE").
    - 1) No Text or Braille required.

- d. Equilateral triangle shape, superimposed within 12" diameter nominal circular shape ("UNISEX").
  - 1) No Text or Braille required.
  - 2) No Braille required.
- 3. Sign Type 5 - Room Identification:
  - a. 7" H x 7" L nominal square shape.
    - 1) 2" high Tactile Text required.
    - 2) Braille required.
  - b. 3 1/2" H x 15" L nominal rectangular shape.
    - 1) 2" high Tactile Text required.
    - 2) Braille required.
  - c. 11" H x 15" L nominal rectangular shape.
    - 1) 2" high Tactile Text required.
    - 2) Braille required.
- 4. Sign Type 6 - Tactile Identification:
  - a. 3-1/2" H x 7" L nominal rectangular shape.
    - 1) 3/4" high Tactile Text required.
    - 2) Braille required.
  - b. 3-1/2" H x 15" L nominal rectangular shape.
    - 1) 3/4" high Tactile Text required.
    - 2) Braille required.
  - c. 7" H x 7" L nominal square shape.
    - 1) 3/4" high Tactile Text required.
    - 2) Braille required.
  - d. 7" H x 15" L nominal rectangular shape.
    - 1) 3/4" high Tactile Text required.
    - 2) Braille required.
- 5. Sign Type 7 - Non-Tactile Identification:
  - a. 3-1/2" H x 7" L nominal rectangular shape.
    - 1) 3/4" high Non-Tactile Text required.
    - 2) No Braille required.
  - b. 3-1/2" H x 15" L nominal rectangular shape.
    - 1) 3/4" high Non-Tactile Text required.
    - 2) No Braille required.
  - c. 7" H x 7" L nominal square shape.
    - 1) 3/4" high Non-Tactile Text required.
    - 2) No Braille required.
  - d. 7" H x 15" L nominal rectangular shape.
    - 1) 3/4" high Non-Tactile Text required.
    - 2) No Braille required.

END OF SECTION

## SECTION 10 14 53 – ROAD AND PARKING SIGNAGE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all walk, road and parking signage materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 32 12 00 PAVEMENT
  - 5. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 6. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
    - a. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect and Civil Engineer.
  - 2. Shop Drawings.
    - a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, the loading, required clearances, method of field assembly, components, and location and size of each field connection.
    - b. Closeout Submittals in accordance with Specification Sections in Division One.

## 1.3 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  - 2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. ADA Americans with Disabilities Act.
    - b. CBC California Building Code, all accessible parking signage shall be as required by CBC 11B-502.

## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:

1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
- B. Acceptance at Site:
  1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
  2. Damaged products will not be accepted.
- C. Storage and protection:
  1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.5 PROJECT CONDITIONS

- A. Existing Conditions:
  1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
  2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.

## 1.6 WARRANTY

- A. Contractor's General Warranty:
  1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty Period One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Signage material:
  1. Signs shall be permanent and reflectorized, constructed of porcelain coating on steel with beaded text or approved equivalent.
  2. Sign materials shall be hot-dipped galvanized, embossed steel, with a heavy-duty baked enamel finish.
    - a. 16 gage steel for all signs larger than 24" x 24".
    - b. 18 gage steel for all signs smaller than 24" x 24".
- B. Brackets:
  1. Galvanized Pipe, attached with vandal resistant fasteners.
    - a. Provide Owner with tool that is compatible with vandal resistant fasteners so that maintenance can be performed on the signs.
- C. Posts:

1. Pipe, galvanized, Schedule 40, in accordance with ASTM A 53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," with compatible galvanized Dome Caps.
- D. Concrete:
  1. See Specification Section – CAST-IN-PLACE CONCRETE.
- E. Other Materials:
  1. Materials not specifically indicated but needed for proper installation shall be new and of first quality as selected by contractor subject to review by the Architect.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Site verification of conditions:
  1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of work under this specification section.
  2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  3. Execution of work under this specification section shall constitute acceptance of existing conditions.

#### 3.2 INSTALLATION

- A. General:
  1. In accordance with Regulatory Requirements.
  2. Set plumb, level, and square.
    - a. Set post plumb and at proper height.
    - b. Place concrete and tamp to assure consolidation.
      - 1) Footings shall be 8" in diameter, 24 inches deep minimum, unless otherwise noted.
      - 2) Top of concrete shall be 3-1/2 inches below finished grade.
    - c. Install brackets so signs are plumb and level.
    - d. The accessible signage shall be centered at the interior end of the parking space at a minimum height of 80 inches from the bottom of the sign to the parking space finished grade, ground or sidewalk.
      - 1) In lieu of posts, the accessible parking space signage may also be centered on the wall at the interior end of the parking space (if applicable) at a minimum of 60 inches from the parking space finished grade, ground or sidewalk. Verify with Architect before using this option.

#### 3.3 SCHEDULE

- A. Parking Entrance Accessible Sign:
  1. A sign shall be posted in a conspicuous place at each entrance to off-street parking facilities.
  2. Size: 17" x 22" minimum.
  3. Lettering: 1" high minimum.
  4. Text: "Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at owner's expense. Towed vehicles may be reclaimed at <insert location> or by telephoning <insert contact information>."



- a. Owner of Project to provide information as a permanent part of the sign. Sign provider to verify information needed with Owner prior to fabrication.
- B. Parking Stall Accessible Sign:
  1. Background: blue reflectorized.
  2. Lettering: 1" high minimum, white reflectorized.
  3. Symbol: International Symbol of Accessibility.
  4. Text: MINIMUM FINE \$250
  5. Add van accessible sign to the parking space identified on the contract drawings.
    - a. Text: VAN ACCESSIBLE
- C. Directional Accessible Sign:
  1. Size: 12" x 18".
  2. Background: blue.
  3. Lettering: 1" high minimum, white reflectorized.
  4. Graphics:
    - a. Text: ACCESSIBLE PARKING
    - b. Symbols: International Symbol of Accessibility and square-tipped directional arrow.
- D. Stop Sign: in accordance with traffic standards in the area where the project is located.
  1. Size & shape: 18" x 18" octagon.
  2. Background: red.
  3. Lettering: 6" high minimum, white reflectorized.
  4. Text: STOP
- E. Bus Entrance Sign: Post in a conspicuous place at each side of the bus drop-off area
  1. Size: 17" x 22" minimum.
  2. Lettering: 1" high minimum.
  3. Text: "Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at owner's expense. Towed vehicles may be reclaimed at <insert location> or by contacting <insert contact information>."
  - a. Owner of Project to provide information as a permanent part of the sign. Sign provider to verify information needed with owner prior to fabrication.
- F. Bus Entrance Only Sign:
  1. Size: 12" x 18".
  2. Background: white.
  3. Lettering: 1-1/2" high letters, red.
  4. Text: BUS ENTRANCE ONLY
- G. Do Not Enter Sign:
  1. Size: 12" x 18".
  2. Background: red.
  3. Lettering: 2" high, white reflectorized.
  4. Text: DO NOT ENTER.
- H. Gate Sign:
  1. Size: 12" x 18".
  2. Lettering: 1" high.
  3. Text: OPERATED BY SECURITY PERSONNEL ONLY
- I. No Parking Sign:
  1. Size: 12" x 18".
  2. Background: white.
  3. Lettering: 1-1/2" high, red.
  4. Text: NO PARKING, BUS PARKING ONLY

- J. Fire Riser Room Route Sign:
1. Size: 12" x 18".
  2. Background: red.
  3. Lettering: 1-1/2" high, white reflectorized.
  4. Text: FIRE RISER ROOM ROUTE

END OF SECTION

## SECTION 10 21 13 – TOILET PARTITIONS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Toilet Partition materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
    - a. High Density Polyethlyene (HDPE) Plastic Toilet Partition Systems.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 08 11 00 METAL DOORS AND FRAMES
  - 5. 09 24 00 CEMENT PLASTER
  - 6. 09 29 00 GYPSUM BOARD
  - 7. 09 30 00 TILE
  - 8. 09 91 00 PAINTING
  - 9. 10 28 13 TOILET ACCESSORIES
  - 10. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. In accordance with the following:
  - 1. AWS American Welding Society

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data:
    - a. Submit manufacturer's full color range (including any standard and premium colors) for selection by the Architect.
    - b. Submit manufacturer's technical data.
  - 2. Shop Drawings:
    - a. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachment to other units of work.
  - 3. Samples:
    - a. Provide two (2) 4 inch square samples of each color selected.
    - b. Provide hardware samples on request.
  - 4. Certificates:
    - a. Provide third party certification that all products comply with NFPA 286.
  - 5. Closeout Submittals in accordance with the following:
    - a. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
    - b. Project Documents in accordance with Specification Section - PROJECT DOCUMENTS.
    - c. Warranty in accordance with Specification Section - WARRANTIES and the article in this section titled "Special Warranty."

#### 1.4 QUALITY ASSURANCE

##### A. Qualifications:

1. Installer Qualifications:
  - a. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product in accordance with manufacturer's warranty requirements.
2. Manufacturer Qualifications:
  - a. Firm experienced in successfully producing products similar to that indicated for this Project, with sufficient production capacity to supply required units without causing delay in the work.

##### B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
  - a. CBC Chapter 11B Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing:
    - 1) Furnish Door Hardware for each accessible stall to comply with ANSI A 117.1 and the CBC Section 11B.
    - 2) Toe Clearance Requirements:
      - a) Toe Clearance shall be in accordance with CBC Section 11B-604.8.1.4 - at least one side partition shall provide a toe clearance of 9 inches (229 mm) minimum above the finish floor and 6 inches (152 mm) deep minimum beyond the compartment-side face of the partition, exclusive of partition support members. Partition components at the clearances shall be smooth without sharp edges or abrasive surfaces.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### A. Packing, shipping, handling, and unloading:

1. Products shall be individually wrapped.
2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.

##### B. Acceptance at Site:

1. Products must be in manufacturer's original unopened containers with labels indicating brand name and model.
2. Damaged products will not be accepted.

##### C. Storage and protection:

1. Products shall be stored in a locked, dry and protected area.

#### 1.6 PROJECT CONDITIONS

##### A. Existing Conditions:

1. Examine the project and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.

#### 1.7 WARRANTY

##### A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

##### B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:

- a. Warranty Period for Solid Plastic Systems Fifteen (15) Years.
- b. Upon project completion and acceptance, the subcontractor shall issue Owner a warranty against defective workmanship and materials.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period One (1) Year.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified Solid Plastic Toilet Partition product manufacturer:
    - a. SCRANTON Products, includes:
      - 1) CAPITOL PARTITIONS
      - 2) COMTEC INDUSTRIES, INC.
      - 3) SANTANA PRODUCTS COMPANY
    - b. Acceptable alternative manufacturer:
      - 1) ACCURATE PARTITIONS CORPORATION.
      - 2) LAMINATING TECHNOLOGIES.
      - 3) As represented by SERVICE ORIENTED SALES.
  - B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

### 2.2 MATERIALS

- A. Solid Plastic: Provide high density polyethylene (HDPE) solid polymer resin with homogeneous color throughout, 1 inch thick with seamless construction and all edges eased, tested in accordance with CBC 803.1.2, 803.13, NFPA 286 (Class A) and ASTM standards as follows:
  - 1. PHYSICAL PROPERTIES:
    - a. Smoke Density per ASTM D 2843 "Test Method for Density of Smoke from the Burning or Decomposition of Plastics":
      - 1) 75 maximum.
    - b. Self Ignition per ASTM D 1929 "Test Method for Determining Ignition Temperature of Plastics":
      - 1) 650 degrees minimum.
    - c. Rate of Burn per ASTM D 635 "Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position":
      - 1) 2.0 cm/min maximum.
    - d. Density per ASTM D 1505 "Test Method for Density of Plastics by the Density-Gradient Technique":
      - 1) 0.96 g/cc.
    - e. Tensile Yield per ASTM D 638 "Test method for Tensile Properties of Plastics":
      - 1) 4400 psi.
    - f. Elongation per ASTM D 638 "Test method for Tensile Properties of Plastics":
      - 1) 600 percent minimum.

- g. Izod Impact per ASTM D 256 "Test methods for Determining the Izod Pendulum Impact Resistance of Plastics".
  - 1) 7.0 ft-lb/inch of notch.
- h. Tensile Impact per ASTM D 1822 "Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials":
  - 1) 120 ft-lb/in<sup>2</sup>.
- i. Brittleness Temp. per ASTM D 746 "Test Method for Brittleness of Plastics and Elastomers by Impact":
  - 1) 76 degrees C maximum.
- j. Hardness per ASTM D 2240 "Standard Test Method for Rubber Property – Durometer Hardness":
  - 1) 68 Shore D.
- k. Flexural Modulus per ASTM D 256 "Test methods for Determining the Izod Pendulum Impact Resistance of Plastics":
  - 1) 220,000 psi.
- 2. Heat Sinc: Provide continuous aluminum edging strips fastened to the bottom edge at full width of doors, screens and panels.

### 2.3 COMPONENTS

A. Unless otherwise stated below, all materials shall be Stainless Steel.

B. Hardware:

- 1. General:
  - a. Provide manufacturer's standard stainless steel, ASTM A 666 "Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar," Type 302 or 304, 18 gage minimum, #4 finish, unless otherwise noted.
  - b. Provide Extruded Aluminum, 6063 T-5 parts with a minimum 0.125 inch wall thickness, at Head Rails and Head Rail Endcaps.
- 2. Hinges: Integral type consisting of :
  - a. Top Pin: 4 inch long, 1/2 inch diameter nylon.
  - b. Lower Pin: "Cam Action" nylon assembly that provides "self-closing feature" for the door with 3/16 inch diameter stainless steel pin inserted in upper cam in accordance with CBC Section 11B-604.8.1.2.
- 3. Door Strike and Keeper:
  - a. Provide surface-mounted door strike and latch keeper for appropriate edge condition and coordinate with latch.
- 4. Latch:
  - a. Provide surface-mounted, stainless steel slide latch conforming to accessibility requirements and pilaster and door conditions.
- 5. Door Bumper and Hook:
  - a. At in-swinging stall doors provide surface-mounted combination hook and rubber-tipped door bumper sized to prevent door hitting mounted accessories.
  - b. At out-swinging stall doors provide surface-mounted rubber-tipped door bumper sized to prevent door hitting mounted accessories.
  - c. All hooks shall be mounted at +48" maximum AFF.
- 6. Door Pull in accordance with CBC Section 11B-404.2.7:
  - a. At stalls that are not identified as accessible, provide manufacturer's standard door pulls.
  - b. At stalls that are identified as accessible, provide pull (or latch assembly) equipped with a loop or "U" Shaped door pull immediately below the latch on both sides of the door conforming to the Americans with Disabilities Act. The latch shall be the sliding, or other hardware not requiring the user to grasp, twist or pinch.
- 7. Wall Bumper:

- a. At out-swinging stall doors provide wall bumper with a rubber face.
- 8. Pilaster Shoes and Sleeves (Caps): 3-inches high, finished to match hardware.
  - a. Furnish galvanized steel supports and leveling bolts at pilasters as recommended in writing by manufacturer to suit floor conditions. Make provisions for setting and securing continuous, extruded aluminum, antigrip, overhead bracing at top of each pilaster with a single crown to prevent the hiding of contraband. Provide shoe at each pilaster to conceal anchorage.
  - b. Provide stainless steel at showers
- 9. Wall Brackets - provide continuous length of panel, one-ear brackets and two-ear brackets as required.
  - a. Wall brackets at shower to be stainless steel
- 10. Panel to Pilaster Brackets - provide continuous length of panel, "U" Shaped brackets.
- 11. Stirrup Brackets- provide one-ear brackets, two-ear brackets, and "U" Shaped brackets as required.
- 12. Head Rails - provide aluminum, anti-grip profile.
- 13. Head Rail Brackets - provide aluminum brackets compatible with Head Rail design.
- 14. Head Rail Endcaps - provide aluminum endcaps compatible with Head Rail design.

## 2.4 ACCESSORIES

- A. Fasteners:
  - 1. Provide manufacturer's standard stainless steel exposed fasteners finished to match hardware, with theft-resistant heads and nuts. For concealed anchors, use hot-dip galvanized, or other rust-resistant protective coated steel.
  - 2. Shower Curtains: vinyl, 42" wide x 72" high with aluminum hooks with self lubricating slides
    - a. All fasteners to be stainless steel

## 2.5 FABRICATION

- A. Toilet Partition Design shall be as follows:
  - 1. Floor-Anchored and Overhead-Braced.
- B. Furnish standard doors, panels, screens, and pilasters fabricated for toilet partition system. Units shall be furnished with cutouts, drilled holes, and reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated on the drawings. Coordinate with Specification Section - TOILET ACCESSORIES, and schedule reinforcements for products actually provided for this project.
  - 1. Doors, panels, and screens shall be 55 inches high and mounted 12 inches above finished floor.
  - 2. Pilasters shall be 82 inches high.
  - 3. Unless otherwise indicated, furnish 24 inch wide in-swinging doors for non-accessible stalls, and 34 inch wide out-swinging doors for front opening accessible stalls.
    - a. 36 inch for side opening accessible stalls.
  - 4. Furnish galvanized steel supports and leveling bolts at pilasters as recommended in writing by manufacturer to suit floor conditions. Provide Pilaster Shoes to conceal anchorage.
  - 5. Secure floor-anchored-overhead braced pilasters by providing continuous Head Rails with Head Rail brackets, and Head Rail Endcaps.
  - 6. All floor anchoring requires a solid two inches thick of solid flooring for proper anchorage.
- C. Urinal Screens: "Floor-Anchored and Overhead-Braced" of the same construction and finish as toilet partitions.
- D. Shower Stall Screens: "Floor Anchored and Overhead-Braced" of the same construction and finish as toilet partitions.

## 2.6 FINISHES

- A. Color shall be selected from the manufacturer's full color range including standard and premium colors.
- B. One color will be selected per room.
- C. Refer to APPENDIX "B": INTERIOR COLOR SCHEDULE.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
  - 2. Coordinate the blocking required in all walls with approved shop drawings.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) that could impair bond of materials specified within this section.

### 3.3 INSTALLATION

- A. General:
  - 1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
  - 2. In accordance with approved submittals.
  - 3. In accordance with Regulatory Requirements.
  - 4. Set plumb, level, and square.
  - 5. Structurally reinforce and anchor work as required.
  - 6. Panels that contain patched holes not utilized for attachment to walls and pilasters will be rejected by the Architect.
- B. Layout:
  - 1. Lines shall be straight and true.
  - 2. Stalls:
    - a. Provide clearances of not less than 1/2 inch between pilasters and panels, and not more than 1 inch between pilasters/panels and walls.
    - b. Secure panels to walls with continuous brackets.
    - c. Secure panels to pilasters with continuous brackets. Brackets are to align with continuous brackets at walls.



- d. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints.
  - e. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall.
  - f. Secure panels in position with manufacturer's written recommended anchoring devices.
  - g. Secure pilasters to floor and level and plumb, and tighten installation with devices furnished.
  - h. Secure head rails to each pilaster with not less than two fasteners.
  - i. Hang doors and adjust so that tops of doors are parallel with head rail when doors are in a closed position. Clearance at vertical edge of doors shall be uniform top and bottom and shall not exceed 1/4 inch.
  - j. When wainscoting prevents the uninterrupted use of a continuous bracket, secure panels to walls with a continuous bracket to the top of the wainscoting and secure the top of the panels to the wall with a stirrup bracket.
3. Screens:
- a. Secure panels to walls with continuous brackets.
  - b. Provide clearances of not more than 1 inch between panels and walls.
  - c. Secure panels in position with manufacturer's written recommended anchoring devices to suit supporting structure.
  - d. Set units to provide support and to resist lateral impact.

#### 3.4 ADJUSTING

- A. Adjust and lubricate for proper operation.
- B. Doors:
  - 1. Adjust and set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched.
  - 2. Adjust and set hinges on out-swinging doors (and entrance swinging doors) to return fully closed positions.
  - 3. Adjust and set hinges on doors at accessible stalls to return to fully closed positions.

#### 3.5 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
  - 1. Clean exposed surfaces using materials and methods recommended in writing by manufacturer.
  - 2. Protect as necessary to prevent damage during the remainder of the construction period.

END OF SECTION

## SECTION 10 26 00 – WALL AND CORNER GUARDS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide all material, labor, equipment and services necessary to completely install all Wall and Corner Guard materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 08 11 00 METAL DOORS AND FRAMES
  - 4. 09 24 00 CEMENT PLASTER
  - 5. 09 29 00 GYPSUM BOARD
  - 6. 09 72 00 WALL COVERINGS
  - 7. 09 91 00 PAINTING
  - 8. 10 05 00 MISCELLANEOUS SPECIALTIES
  - 9. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. ASTM American Society of Testing Materials
  - 2. NFPA National Fire Protection Association

## 1.3 SUBMITTALS

- A. Submit in accordance with Project Manual Specification Section - SUBMITTAL PROCEDURES:
- B. Coordination Drawings:
  - 1. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.
- C. Product Data.
  - 1. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
    - a. Provide data for each type of rigid vinyl kickplates specified.
- D. Shop Drawings.
  - 1. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
- E. Samples.
  - 1. Provide 8-inch square sample of each color and pattern selected.
  - 2. Provide 6-inch lineal samples of each piece of trim material specified.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
- B. Project Record Documents in accordance with Specification Section - PROJECT RECORD Documents.
- C. Warranty in accordance with Specification Section - WARRANTIES.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:

- a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
  - B. Regulatory Requirements:
    - 1. In accordance with Project Manual Specification Section - REGULATORY REQUIREMENTS, and the following:
      - a. ADA Americans with Disabilities Act of 1990.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Packing, shipping, handling, and unloading:
    - 1. Products shall be individually wrapped.
    - 2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
  - B. Acceptance at Site:
    - 1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.
    - 2. Damaged products will not be accepted.
  - C. Storage and protection:
    - 1. Products shall be stored in a dry, protected area.
- 1.7 PROJECT CONDITIONS
- A. Environmental requirements:
    - 1. Temperature: acclimate products in environment between sixty-five (65) degrees Fahrenheit and seventy (70) degrees Fahrenheit for one (1) day prior to installation.
  - B. Existing Conditions:
    - 1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
- 1.8 WARRANTY
- A. Contractor's General Warranty:
    - 1. In accordance with Specification Section - WARRANTIES.
  - B. Manufacturer's Warranty: 1 Year.
    - 1. In accordance with manufacturer's written standard warranty.
  - C. Installer's Warranty: 1 Year.
    - 1. In accordance with the terms of the Specification Section – WARRANTIES.

## PART 2 - PRODUCTS

- 2.1 PERFORMANCE REQUIREMENTS
- A. Fire Performance Characteristics.
    - 1. Class A under ASTM E 84 "Test Method for Surface Burning Characteristics of Building Materials":
      - a. Flame Spread: 25 or less.
      - b. Smoke Developed: 450 or less.
  - B. Impact Strength:
    - 1. Provide rigid sheet materials that have an Impact Strength of 30.4 ft-lbs/inch of thickness as tested in accordance with the procedures specified in ASTM D 256 "Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics."
  - C. Chemical and Stain Resistance
    - 1. Provide wall protection system components with chemical and stain resistance in accordance with ASTM D 543 "Practices for Evaluating the Resistance of Plastics to Chemical Reagents."

- D. Fungal and Bacterial Resistance:
  - 1. Provide material that does not support fungal or bacterial growth as tested in accordance with ASTM G 21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi."
- E. Color Consistency:
  - 1. Provide components matched in accordance with SAE J-1545 – (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.
- F. Accessibility Compliance:
  - 1. Comply with ADA requirements and requirements of ANSI A117.1.

## 2.2 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified product manufacturer, or approved equivalent:
    - a. INPRO CORPORATION
    - b. KOROSEAL (Division of RJF INTERNATIONAL CORPORATION)
    - c. Acceptable alternative manufacturers:
      - 1) ACROVYN as manufactured by The C/S GROUP
      - 2) KOROSEAL (Division of RJF INTERNATIONAL CORPORATION)
- B. Products from other manufacturers not listed must submit in accordance with Project Manual Specification Section - SUBSTITUTION PROCEDURES.

## 2.3 CORNER GUARDS

- A. Vinyl/Acrylic Flush Corner Guards:
  - 1. INPRO Model # 160 (2 inch x 2 inch x 8 feet):
    - a. When wall height exceeds maximum length available (12 feet), splice to be placed near the ceiling at the highest point practical for full height installation.
    - b. Provide manufacturer's standard Vinyl/Acrylic extrusions in a nominal wall thickness of 0.080".
    - c. Finish to be manufacturer's matte "Pebblette" finish in color as selected by Architect from manufacturer's full color range.
    - d. Chemical and stain resistance shall be in accordance CSAV-280 standards, established by the manufacturer.
    - e. Provide continuous aluminum retainer 0.070" nominal thickness including attachment of hardware for a complete assembly.

## 2.4 HIGH IMPACT WALL COVERING

- A. High Impact Wall Covering:
  - 1. INPRO "Rigid Vinyl Sheet" Item protective wall covering panels in sizes indicated on the drawings.
    - a. Provide manufacturer's standard vinyl/ acrylic extrusions in a nominal wall thickness of 0.060".
    - b. Provide manufacturer's recommended adhesive for the substrate material indicated on the drawings.
    - c. Finish to be manufacturer's matte "Pebblette" finish in color as selected by Architect from manufacturer's full color range.
    - d. Provide the manufacturer's recommended trim pieces and fabricated configurations as required by the drawings.
  - 2. ACROVYN PVC free protective wall covering panels in sizes indicated on the drawings.

- a. Provide manufacturer's standard PETG extrusions in a nominal wall thickness of 0.060".
  - b. Provide manufacturer's recommended adhesive for the substrate material indicated on the drawings.
  - c. Finish to be manufacturer's matte finish "Pebblette Grain" in color as selected by Architect from manufacturer's full color range.
  - d. Provide the manufacturer's written recommended trim pieces and fabricated configurations as required by the drawings.
3. KOROSEAL "Korogard" protective wall covering panels in sizes indicated on the drawings:
- a. Provide manufacturer's standard vinyl/ acrylic extrusions in a nominal wall thickness of 0.060".
  - b. Provide manufacturer's written recommended adhesive for the substrate material indicated on the drawings.
  - c. Provide the manufacturer's written recommended trim pieces and fabricated configurations as required by the drawings.

## 2.5 COMPONENTS

- A. End caps, outside corners and inside corners shall be made of injection molded thermoplastics.
1. Joints:
    - a. Inside Corners: Color to match wall protection.
    - b. Joint Sealants: Color to match wall protection.

## 2.6 ACCESSORIES

- A. All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Site verification of conditions:
1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual, which affect the execution of work under this specification section.
  2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  3. Execution of work under this specification section shall constitute acceptance of existing conditions.

## 3.2 INSTALLATION

- A. General:
1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
    - a. Provide continuous blocking in walls of similar materials as the wall construction to properly anchor the continuous handrail system at the height indicated on the drawings. Fasteners shall be placed at 32" o.c. maximum.
  2. In accordance with approved submittals.
  3. In accordance with Regulatory Requirements.
  4. Set plumb, level, and square.
- B. Minimum temperature requirements for all products must be +70 deg. F. Relative humidity shall not exceed 80 percent.
- C. Layout:
1. Lines shall be straight and true.

**3.3 CLEANING**

- A.** Clean in accordance with Project Manual Specification Section - PROJECT CLOSEOUT.
  - 1. Clean any soiled surfaces immediately.
  - 2. Clean any soiled surfaces at the end of each day, minimum.
  - 3. In accordance with manufacturer's written instructions and recommendations.

**END OF SECTION**

## SECTION 10 28 13 – TOILET ACCESSORIES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Furnish all material, labor, equipment and services necessary to furnish Toilet Accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 08 80 00 GLASS
  - 4. 09 24 00 CEMENT PLASTER
  - 5. 09 29 00 GYPSUM BOARD
  - 6. 09 30 00 TILE
  - 7. 09 72 00 WALL COVERINGS
  - 8. 10 21 13 TOILET PARTITIONS
  - 9. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
  - 1. Product Data.
  - 2. Shop Drawings.
    - a. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location (including ADA Required dimensions for mounting locations), and size of each field connection.

## 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. ADA American's with Disabilities Act 1990.
    - b. ANSI American National Standards Institute Specifications ANSI A117.1 "Accessible and Usable Buildings and Facilities".
    - c. CBC California Building Code (California State Building Standards Code - Title 24) and the latest edition of DSA's California Access Compliance Advisory Reference Manual.

## 1.4 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period [One (1) Year.][Five (5) years.]

## PART 2 - PRODUCTS

- A. See Schedule in PART 3.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. All Toilet Room Accessories shall be furnished and installed by the Contractor, in accordance with manufacturer's written recommendations, and in accordance with accessibility mounting height.
- B. Install in accordance with CBC and ADA Accessibility Chapters and Sections, and ANSI A 117.1.

## 3.2 SCHEDULES

- A. All devices listed herein shall be installed where shown, complete, and ready for use in full compliance with all applicable codes and standards. The manufacturers listed are acceptable as approved suppliers to the Owner (**STATE CENTER COMMUNITY COLLEGE DISTRICT**). Substitution of manufacturers other than those listed, must be approved by the Owner.
- B. Hand Dryers:
1. Hands Free 208 V, 1600W, surface mounted, Polycarbonate-ABS.
    - a. Acceptable manufacturers:
      - 1) Dyson AB14-G Airblade dB Hand Dryer, Polycarbonate ABS gray.
- C. Toilet Tissue Dispenser -- All Stalls:
1. Non-controlled delivery, quad roll, 11-3/4" wide, 13.25" high projects 6.9" from wall, surface mounted.
    - a. Acceptable manufacturer:
      - 1) GEORGIA-PACIFIC Model 56746A.
- D. Paper Towel Dispenser:
1. ENMOTION® 10" Automated Touchless Paper Towel Dispenser 9.500" deep x 14.700" wide x 17.3" high surface mounted.
    - a. Acceptable manufacturer:
      - 1) GEORGIA-PACIFIC Model 59462A -- Black.
- E. Sanitary Napkin Disposal:
1. Surface mounted stainless steel.
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-270.
      - 2) BRADLEY 4781-15.
- F. Soap Dispenser:
1. Automatic Foam Soap/Sanitizer Dispenser , 4 5/8" Wide x 14 1/16" High x 7 1/8" Deep, surface mounted.
    - a. Acceptable manufacturer:
      - 1) GEORGIA-PACIFIC Model 52057 -- Black.
- G. Accessible Shower Seat:
1. Folding "L" Shaped seat, 33" x 20" nominal, Solid Phenolic seat, Stainless Steel Tubing and Brackets, with brackets for positive "catch" in the "up" position.
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-5181.
      - 2) BRADLEY 9569.
- H. Mop Holder (All janitor's rooms):
1. Stainless steel, 36" long - 4 holders.
    - a. Acceptable manufacturers:



- 1) BOBRICK B-223 x 36.
  - 2) BRADLEY 9954.
- I. Grab Bars:
  1. 1-1/2" diameter, 18 gage seamless, stainless safety-grip finish, exposed mounting, vandal resistant screws, minimum of three attachment points matching attachment configuration shown on drawings, in configuration as required.
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-6806-99.
      - 2) BRADLEY 812-2.
  2. Accessories:
    - a. Partition Mounted Grab Bar Anchors
      - 1) BOBRICK 258
- J. Grab Bars-Shower:
  1. 1-1/2" diameter, 18 gage seamless, stainless safety-grip finish, exposed mounting, vandal resistant screws, in configuration as required.
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-6816-99.
- K. Shower Curtain Rod:
  1. Concealed mounting, 1" diameter, stainless steel.
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-207.
      - 2) BRADLEY 9538.
- L. Mirrors:
  1. One piece channel frame, galvanized steel back, wall mounted for accessibility as detailed on the drawings, 1/4" tempered glass, size as shown.
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-165 Series.
      - 2) BRADLEY 781.
- M. Waste Receptacles:
  1. Owner Furnished, Owner Installed.
- N. Seat Cover Dispenser (All Men and Women's Restrooms):
  1. Stainless Steel, Surface Mounted
    - a. Acceptable manufacturers:
      - 1) BOBRICK B-221.
      - 2) BRADLEY 5831.

**SECTION 10 44 00 – FIRE PROTECTION SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to furnish and install Fire Protection Specialties, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 05 12 00 STEEL AND FABRICATIONS
  - 4. 09 24 00 CEMENT PLASTER
  - 5. 09 29 00 GYPSUM BOARD
  - 6. 09 72 00 WALL COVERINGS
  - 7. 09 91 00 PAINTING
  - 8. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.

**1.2 REFERENCES**

- A. Standards:
  - 1. In accordance with the following standards:
    - a. NAAMM National Association of Architectural Metal Manufacturers

**1.3 SUBMITTALS**

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES.
  - 1. Product Data, indicating Project, location in Project for each Model Number for Fire Extinguishers, Fire Blankets, Cabinets, Doors and Trim

**1.4 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three [3] projects of similar scope and size to that indicated for this Project.
  - 2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
    - a. NFPA National Fire Protection Association (NFPA 10).

**1.5 WARRANTY**

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty:
  - 1. In accordance with manufacturer's written standard warranty:
    - a. Warranty Period One (1) Year.
  - 2. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
    - a. Failures include, but are not limited to, the following:
      - 1) Failure of hydrostatic test according to NFPA 10.
      - 2) Faulty operation of valves or release levers.
        - a) Warranty Period: Six (6) years from date of Substantial Completion.
- C. Installer's Warranty:
  - 1. In accordance with the terms of the Specification Section - WARRANTIES:
    - a. Warranty period **[Five (5) years.]**

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified product manufacturer, or approved equivalent:
    - a. LARSEN'S MANUFACTURING CO.
      - 1) Special hardware when required "Larsen-Loc".
        - a)
      - 2) FEC-3:
        - a) Non-rated Model #AL 2409-R1.
        - b)
        - c) Fire Extinguisher Model #MP5-A.
    - b. Acceptable alternative manufacturer:
      - 1) JL INDUSTRIES
  - 2. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

**2.2 MANUFACTURED UNITS**

- A. Cabinet and Extinguisher Types:
  - 1. Fully Recessed "Architectural Series" Type FEC-3.
    - a. Where wall depth is sufficient to accept complete box depth.

- b. Non-Rated: Model No. AL 2409-R1, for rough opening of 25"H x 10-1/2"W x 5-1/4"D. Box is to be fabricated from manufacturer's standard heavy gage steel, white baked enamel box. Provide at non-rated walls.
- c. Fire Rated: Model No. AL-FS-2409-R1, for rough opening of 26 1/8"H x 11-5/8"W x 6-1/8"D. Box is to be fabricated from manufacturer's standard heavy gage steel, white baked enamel, fire rated box. Provide at one-hour or two-hour rated walls.
- d. Provide 5/16 inch Flat Edge Trim all around, fabricated from extruded aluminum with a clear satin anodized finish, with all corners mitered.
- e. Typical Door (1/2" thick) to be "Vertical Duo" with tempered glass. Door to be fabricated from extruded aluminum with a clear satin anodized finish with "Black" Vertical Style Die Cut Lettering indicating "FIRE EXTINGUISHER" placed on the hinge side of the cabinet door.
  - 1) Vandal Resistant Solid Door (1/2 inch thick). Door to be fabricated from extruded aluminum with a clear satin anodized finish with "Black" Vertical Style Die Cut Lettering indicating "FIRE EXTINGUISHER" placed on the hinge side of the cabinet door. Provide at the following locations only that are subject to impact and vandalism:
    - a) Building Exteriors.
    - b)
- f. Typical Door Hardware shall include a satin finish pull handle with a self-adjusting roller latch and a continuous piano hinge.
  - 1) Vandal Resistant Hardware: Provide "Larsen-Loc" and factory applied Type A Style lettering near the handle that reads "IN CASE OF FIRE ONLY – PULL FIRMLY ON HANDLE". Provide at the following locations only subject to vandalism:
    - a) Building Exteriors.
- g. Provide Multi-Purpose Fire Extinguisher with a UL Rating of 3A-40B:C or 4A-80B: C at Science Classrooms and Vocational Shops.

## 2.3 FABRICATION

- A. Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
  - 2. Prepare doors and frames to receive locks.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 1. Fabricate door frames of one-piece construction, with edges flanged.
  - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

**2.5 STEEL FINISHES**

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Baked-Enamel Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affect the execution of work under this specification section.
    - a. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed.
    - b. Examine walls and partitions for suitable blocking where surface applied brackets will be installed.
    - c. Examine fire extinguishers for proper charging and tagging.
      - 1) Remove and replace damaged, defective, or undercharged units.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

**3.2 PREPARATION**

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's written instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.) which could impair bond of materials specified within this section.

**3.3 INSTALLATION**

- A. General:
  - 1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.

2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
  - a. Comply with all applicable ADA and CBC requirements in regards to accessible mounting heights.
4. Set plumb, level, and square.
5. Identification:
  - a. Apply decals, vinyl lettering, or other identification devices at locations indicated.

- B. Layout:
1. Lines shall be straight and true.

### 3.4 ADJUSTING

- A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
1. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

### 3.5 CLEANING

- A. Clean in accordance with Specification Section - PROJECT CLOSEOUT.
1. Clean any soiled surfaces immediately.
  2. In accordance with manufacturer's written instructions and recommendations.
    - a. Remove temporary protective coverings and strippable films, if any, as security fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
    - b. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
    - c. On completion of cabinet installation, clean interior and exterior surfaces as recommended in writing by manufacturer.
    - d. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended in writing or furnished by cabinet manufacturer.

### 3.6 PROTECTION

- A. Protection from traffic:
1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.

END OF SECTION

**SECTION 105116 - PLASTIC LAMINATE LOCKERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all Plastic Laminate Lockers materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
- B. Related Sections: The following Project Manual Sections contain requirements that relate to this section:
  - 1. SPECIFICATION SECTIONS IN THE FACILITY CONSTRUCTION SUBGROUP.
  - 2. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 3. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

**1.3 REFERENCES**

- A. Standards:
  - 1. In accordance with the following standards:
    - a. BHMA BHMA stands for Builders Hardware Manufacturers Associates, Inc.
    - b. NAAWS "North American Architectural Woodwork Standards," Latest Edition, including latest amendments, by the Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada, and the Woodwork Institute.
    - c. NEMA National Electrical Manufacturers' Associates, Publication Number LD3, latest-edition
    - d. NIST National Institute of Standards and Technology
    - e. NWMA "Industrial Standard" National Woodwork Manufacturer's Association.
    - f. PS Product Standard of the U. S. Department of Commerce
    - g. WI Woodwork Institute

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- B. Product Data:
  - 1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
  - 2. Include preparation, storage and handling requirements.
  - 3. Include installation guide.
  - 4. Include product data specific to materials used in construction of locker.

5. Submit manufacturer's full color range (including any standard, premium and custom colors) for selection by the Architect.
  - C. Shop Drawings.
    1. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.
    2. Submit Elevation Drawings: Indicate locker component profiles and elevations, schedule of finishes, and accessories.
    3. Submit Locker Room Layout: Show a plan view of each room receiving lockers, scaled locker location, trim pieces, and ADA compliance.
  - D. Samples.
    1. Finishes:
      - a. Provide 12 inch square sample of each color and pattern selected.
    2. Accessories/Trim/Etc.
      - a. Provide 6 inch lineal samples of each piece of trim material specified.
  - E. Closeout Submittals in accordance with the following:
    1. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
    2. Record Documents in accordance with Specification Section - RECORD DOCUMENTS.
    3. Warranty in accordance with Specification Section - WARRANTIES.
- 1.5 QUALITY ASSURANCE
- A. Qualifications:
    1. Installer Qualifications:
      - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.
    2. Manufacturer/Supplier Qualifications:
      - a. Firm experienced in successfully producing/supplying products, similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
  - B. Regulatory Requirements:
    1. In accordance with Specification Section - REGULATORY REQUIREMENTS, and the following:
      - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA), in the area where the Project is located.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Packing, shipping, handling, and unloading:
    1. Products shall be individually wrapped.
    2. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage.
  - B. Acceptance at Site:
    1. Products must be in manufacturer's original unopened containers with labels indicating brand name, model, and grade.



2. Damaged products will not be accepted.

C. Storage and protection:

1. Products shall be stored in a dry, protected area.

1.7 PROJECT CONDITIONS

A. Environmental requirements:

1. Temperature: Maintain ambient temperature in space to receive products at sixty-eight (68) degrees Fahrenheit for two (2) days prior, during, and two (2) days minimum following installation.
  - a. After this period, maintain a temperature of not less than 55 degrees Fahrenheit.
  - b. After installation, at no such time shall the temperature exceed 85 degrees Fahrenheit.
  - c. Inform the Owner of ambient temperature requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.
2. Humidity: Maintain humidity in space to receive products between 6 percent to 9 percent for four (4) days minimum prior, during, and following installation in accordance with manufacturer's recommendations. Inform the Owner of humidity requirements for products installed and maintain until Substantial Completion and turn-over of the building or facility to the Owner.

1.8 WARRANTY

A. Contractor's General Warranty:

1. In accordance with Specification Section - WARRANTIES.

B. Manufacturer's Warranty:

1. In accordance with manufacturer's written standard warranty:
  - a. Warranty Period Five (5) Year.

C. Installer's Warranty:

1. In accordance with the terms of the Specification Section - WARRANTIES:
  - a. Warranty period One (1) Year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.

1. Specified product manufacturer:
  - a. RFS SPORTS, INC. "Athletic Team Lockers –  
Impact Phenolic"

- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 MATERIALS

- A. Locker Frame:
1. Material shall be Solid Phenolic with a High Pressure finish surface made as an integral part of the core material. Laminated surfaces are not acceptable. Surface and edges shall be non-porous and shall not support fungus or bacteria. Provide material which has been selected for uniform color, surface flatness and smoothness. Exposed surfaces which exhibit discolorations, pitting, seam marks, roller marks, stains, telegraphing of core material, or other imperfections on finished units are not acceptable. Defects such as chipping along edges and corners are unacceptable.
- B. Face: Wilsonart Laminate, Refer to Interior Color Schedule.
- C. Edges: Exposed edges to be black Phenolic.
- D. Venting: 12mm air flow opening.
- E. Configuration: Athletic.
1. Athletic: LS Model Lockbox with flip lid seat, stay lift hinge and ventilated metal grill footlocker.
  2. Athletic ADA : Open adjustable Shelves. Refer to Drawings.
- F. Hardware:
1. Hooks: Standard: 4 - Double Garment Hooks.
  2. Pull: 6" Satin Nickel Bar Pull.
  3. Hardware for connecting lockers and securing trim provided by RFS Sports.
- G. Accessories:
1. Infinity number plate: 2-inch-tall inlaid stainless-steel number plate.
  2. Lockbox Lock: DIGILOCK Axis
    - a. Body Style: Pull Handle
    - b. Brush Nickel
    - c. ADA Compliant User Key
  3. 2-inch Vinyl Seat Cushion with Logo.
    - a. Vinyl Color: Standard Color, Refer to Interior Color Schedule.
  4. Base Trim: 4 inches.
  5. Filler, End, Double End Panels.
    - a. Exposed faces to be high-pressure decorative laminate to match Locker Frame.
  6. Valance: 2"
    - a. Exposed faces to be high-pressure decorative laminate to match Locker Frame.
  7. Logo: Acrylic Emblem, Decal.
    - a. Refer to Drawings for location.
    - b. Color to Match School Colors. Request custom colors and Artwork from Architect.

## 2.3 MATCHING MILLWORK

- A. Benches:
1. Material:
    - a. Impact Color, Match Locker.

- 2. Legs:
  - a. Square Steel.

## 2.4 FABRICATION

- A. Shop Assembly:
  - 1. Fabricate and manufacture in the United States of America.
  - 2. Lockers shall be fabricated using doweled/glued & screwed assembly process.
- B. Fabrication Tolerances:
  - 1. Fabricate lockers square, rigid and without warp, with the finish free of defects.
  - 2. Machine all parts and attachment holes accurately and without chips and defects.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual that affects the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  - 1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.
  - 2. Verify prepared bases are in correct position and configuration per shop drawings and locker layout.
  - 3. Verify space is 100% "conditioned" and will remain so throughout and after the installation.
- B. Protection:
  - 1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.
- C. Surface preparation:
  - 1. Prepare surface in accordance with manufacturer's instructions and recommendations.
  - 2. Clean substrates of substances (oil, grease, compounds, incompatible primers, etc.) which could impair bond of materials specified within this section.

### 3.3 ERECTION / INSTALLATION

- A. General:
  - 1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.

2. In accordance with approved submittals.
3. In accordance with Regulatory Requirements.
4. Set plumb, level, and square.

**B. Layout:**

1. Lines shall be straight and true.

**3.4 CLEANING**

**A. Clean in accordance with Specification Section - TEMPORARY FACILITIES AND CONTROLS.**

1. Leave area level and free of any ruts or debris. Appearance of earth surface shall be equal to or better than adjacent undisturbed surfaces.
2. Clean any soiled surfaces immediately.
3. Clean any soiled surfaces at the end of each day, minimum.
4. Finish shall be clean and ready for the application of any additional finishes.
5. In accordance with manufacturer's instructions and recommendations.

**3.5 PROTECTION**

**A. Protection from weather:**

1. Protect newly installed work from freezing for twenty-four (24) hours after erection, installation or application.

**B. Protection from traffic:**

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures the work of this section being without damage or deterioration until the time of Substantial Completion.
2. Immediately after cleaning, neatly apply four (4) mil thick, minimum, polyethylene film over finished surfaces at traffic areas. Fasten film firmly to surface.

**3.6 SCHEDULES**

**A. Locker Schedule Per Room:**

1. Room 105 Team Room (Refer to Drawings).

<b>a. TYPE</b>	<b>SIZE (INCHES) W x D x H</b>	<b>QUANTITY</b>
b. Athletic	20 x 18 x 84	22
c. Athletic ADA	20 x 18 x 84	2
d. Bench	72 x 15 x 18	2
e. Bench	48 x 15 x 18	2
f. Bench ADA	48 x 24 x 18	1
2. Room 115 Team Room (Refer to Drawings).

<b>a. TYPE</b>	<b>SIZE (INCHES) W x D x H</b>	<b>QUANTITY</b>
b. Athletic	20 x 18 x 84	24
c. Athletic ADA	20 x 18 x 84	2
d. Bench	72 x 15 x 18	2
e. Bench	48 x 15 x 18	2
f. Bench ADAS	48 x 24 x 18	1

**END OF SECTION**

## SECTION 10 75 00 – FLAGPOLES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide all materials, labor, equipment and services necessary to furnish flagpole, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 11 01 CONCRETE FORMWORK
  - 4. 03 20 00 REINFORCEMENT
  - 5. 03 30 00 CAST-IN-PLACE CONCRETE
  - 6. 31 20 00 EARTHWORK
  - 7. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 8. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 REFERENCES

- A. Standards:
  - 1. AA The Aluminum Association
  - 2. DAV Disable American Veterans, U.S Flag Code

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- B. Product Data:
  - 1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.
- C. Shop Drawings:
  - 1. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
    - a. Where installed products are indicated to comply with certain design loading, include structural computations, material properties, and other information needed for structural analysis that has been signed and stamped by a registered Civil or Structural Engineer in the State of California.
- D. Quality Assurance/Control Submittals:
  - 1. Engineering Calculations.
    - a. Submit 5 copies of calculations showing flagpole to have strength required to resist forces applied to it. Calculation in accordance with regulatory agencies and computed and signed by a professional engineer registered in the State of California.

## 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this Project.

- b. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
  - 2. Manufacturer/Supplier Qualifications:
    - a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the work.
- B. Regulatory Requirements:
  - 1. In accordance with Specification Section - REGULATORY REQUIREMENTS.

## 1.5 WARRANTY

- A. Contractor's General Warranty:
  - 1. In accordance with Specification Section - WARRANTIES.
- B. Manufacturer's Warranty: 1 Year.
  - 1. In accordance with manufacturer's written standard warranty.
- C. Installer's Warranty: 1 Year.
  - 1. In accordance with the terms of the Specification Section – WARRANTIES.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

### 2.2 MATERIALS

- A. Foundation materials:
  - 1. Galvanized steel tube with self-centering bottom plate and lightning protector ground spike. Refer to Drawings for length of tube.
- B. Concrete:
  - 1. In accordance with Specification Section - CAST-IN-PLACE CONCRETE.

### 2.3 GROUND-MOUNTED FLAGPOLE

- A. Specified Ground-Mounted Flagpole product manufacturer, or approved equivalent:
  - 1. POLE-TECH CO., INC. Model #PT306CIW.
  - 2. Acceptable alternative manufacturers:
    - a. CONCORD AMERICAN FLAGPOLE
    - b. EDER FLAG COMPANY
- B. Material:
  - 1. Seamless, cold drawn, heat-treated, age hardened, 6063-T6 complying with ASTM B-241, thickness of 0.156 inch minimum.
  - 2. Finish: Aluminum, directional textured mechanical satin finish, AA-M32.
  - 3. Cone tapered uniform straight-line rate of 1" every 50 feet.

4. Workmanship: Fabricate all joints and seams to be inconspicuous. Grind all exposed welds smooth, and finish to match pole shaft.
- C. Features:
1. Ball: 6-inch 14 gage spun aluminum with gold anodized finish.
  2. Truck: Double sleeve, B.D. ball bearing, non-fouling revolving aluminum truck.
  3. Internal Halyard, flagpole fittings-groundset aluminum flagpole:
    - a. System to include a heavy-duty cast aluminum-revolving truck and hood with a heavy-duty stainless steel direct drive winch with a removable handle.
    - b. Winch is to be manually operated and has a spring-loaded friction brake to lock the flag at any position on the pole.
    - c. The winch is accessible through a flush pivot access door with cylindrical lock and a continuous aluminum piano hinge.
    - d. Flag descent system consists of a plastic beaded sling, that encircles the pole and it's attached to a neoprene coated counterweight at the halyard end.
    - e. The flag is attached to two(2) stainless steel snaphooks that are attached to a 1/8" diameter 7 x 19 construction stainless steel aircraft cable halyard.
  4. Cleats: Aluminum.
  5. Cleat Cover and Protective Pipe: Aluminum.
  6. Flash Collar: Spun aluminum flash collar finished to match flagpole finish.
  7. Wall Mount Steel Tube mandrel with custom base plate and lighting protector as recommended in writing by manufacturer.
  8. Refer to detailed drawings and coordinate with structural steel supplier.
  9. Flags (Provided by Owner):
    - a. USA – 6' x 10'.
    - b. California – 5' x 8'.
- D. Finish:
1. Exposed surface: Satin brush and waxed.
  2. Portion in Concrete:
    - a. Shop painted inside and outside with black asphaltum.
    - b. Refer to Drawings for depth into concrete.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. In accordance with approved shop drawings and manufacturer's written recommendations.
- B. Excavation as required and in accordance with Specification Section - EARTHWORK.
- C. Pour concrete foundation integral with foundation tube and bottom plate.
- D. Set flagpole plumb in dry packed sand.
- E. Install accessories as required.

END OF SECTION

## SECTION 11 66 43 – SCOREBOARDS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. This Section:

1. Provide all material, labor, equipment and services necessary to completely install all Scoreboard materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.
  - a. Scoreboard.
  - b. Sports Video Display.
  - c. Stadium Sound System.
  - d. Control System.
  - e. Scoring Console.
  - f. Identification and Sponsor Signage.
  - g. Service and support.

## B. Related Sections:

1. DIVISION 00 SPECIFICATION SECTIONS.
2. DIVISION 01 SPECIFICATION SECTIONS.
3. 03 30 00 CAST-IN-PLACE CONCRETE
4. 05 12 00 STEEL AND FABRICATIONS
5. 07 40 00 METAL PANELS
6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
7. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SUBMITTALS

## A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:

## B. Product Data.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

## C. Shop Drawings.

1. Submit shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loading, required clearances, method of field assembly, components, and location and size of each field connection.

## D. Quality Assurance/Control Submittals:

1. Manufacturer's Written Instructions:
  - a. Submit 3 copies of manufacturer's written instructions.

## E. Closeout Submittals in accordance with Specification Sections in Division One:

1. Maintenance Data in accordance with Specification Section - PROJECT CLOSEOUT.
2. Operation Data in accordance with Specification Section - PROJECT CLOSEOUT.
3. Project Documents in accordance with Specification Section - PROJECT DOCUMENTS.
4. Warranty in accordance with Specification Section - WARRANTIES.

## 1.3 QUALITY ASSURANCE

## A. Qualifications:

1. Installer Qualifications:
  - a. Engage an experienced Installer who is certified in writing by the manufacturer listed herein as qualified to install manufacturer's product (or system) in accordance with manufacturer's warranty requirements.
2. Manufacturer/Supplier Qualifications:



- a. Firm experienced in successfully producing/supplying products similar to that indicated for this Project, with sufficient production/supply capacity to produce/supply required units without causing delay in the Work.
  - B. In accordance with Specification Section - REGULATORY REQUIREMENTS.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Packing, shipping, handling, and unloading:
    - 1. Products shall be handled in such a manner as to assure that they are free from dents, scratches and other damage. Damaged products will not be accepted at final inspection.
  - B. Storage and protection:
    - 1. Products shall be stored above ground on level platforms, six (6) inches above ground, allowing air circulation under stacked units.
      - a. Cover materials and protect against wetting prior to use.
- 1.5 WARRANTY
- A. Contractor's General Warranty:
    - 1. In accordance with Specification Section - WARRANTIES.
  - B. Manufacturer's Warranty:
    - 1. In accordance with manufacturer's written standard warranty:
      - a. Warranty Period One (1) Year.
    - 2. Provide manufacturer's special warranty to begin upon date of substantial completion against defects in workmanship or material, and that the manufacturer will replace or repair without cost to the Owner all items associated with the scoreboard system.
      - a. Warranty Period Five (5) Years.
    - 3. Provide on-site service warranty covering parts and labor.
      - a. Warranty Period Five (5) Years.
  - C. Installer's Warranty:
    - 1. In accordance with the terms of the Specification Section - WARRANTIES:
      - a. Warranty period Five (5) Years.
- 1.6 OWNER'S INSTRUCTIONS
- A. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below:
    - 1. Test and adjust controls and any safeties. Replace damaged or malfunctioning controls and equipment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
  - 1. Specified product manufacturer, or approved equivalent:
    - a. NEVCO.
    - b. Acceptable alternative manufacturers, subject to DSA Pre-approval:

- 1) DAKTRONICS.
- 2) ALL AMERICAN SCOREBOARD.

B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

## 2.2 SCOREBOARD

A. Basis-Of-Design: Model 3685-EC-W Scoreboard.

1. Dimensions: 24' Wide x 8' High x 8" Deep.
2. Scoreboard Color: PMS 638C
3. Digit Color: White.
4. Electronic Programmable Captions: White
5. Scoreboard Logo: 51.5" Wide x 43" High on face of scoreboard.
  - a. Logo to be supplied by Owner.

## 2.3 SPORTS VIDEO DISPLAY

A. Wide-angle, Full-Color Sports Displays

1. Pixel resolution: 10mm physical pixel resolution.
2. No less than 384 pixels in height and 576 pixels in length.
3. Minimum Active Display Area: 18.9 feet wide by 12.6 feet tall.
4. Color capability: Minimum 550 billion colors.
5. Frame speed: At or greater than 60 frames per second.
6. Display intensity: Adjustable to 32 levels.
7. Minimum brightness: 7000 nits.
8. Operating temperature: -40 degrees F – 150 degrees F
9. Viewing angle: 140 Horizontal, 60 Vertical.
10. Contrast ratio: Minimum 2000: 1
11. Refresh rate shall be greater than 2400+Hz.
12. LED life expectancy: Minimum of 100,000 hours.
13. Service accessibility for all components shall be from the front.
14. Must include redundant power and signal capability.
15. Display face: Includes low-glare features to optimize display contrast.

## 2.4 STADIUM SOUND SYSTEM

A. Model SP (Stadium Pro) 1500EV

1. Speaker Cabinet Dimensions: 9' Wide x 4' High.
  - a. Speakers (2) / Subwoofer (1)
2. Scrim Size: 280" Wide x 36.5" High.
3. Printable Scrim Area: 280.5" Wide x 31" High.
4. Scrim Color: #76 Print Black.
5. Imprint Color: White.
6. Power Amplifiers (2)
7. Power Sequencer (1)
8. Equipment Rack: 1-14 Space
9. Touchscreen Mixer
10. Announcer Mic With Stand.

## 2.5 CONTROL ROOM EQUIPMENT

A. Model HS-1600T Mobile Studio.

1. 4-input mobile studio with built-in HD switcher.
  - a. 2 each remote control PTZ cameras.
  - b. Instant Replay with dual monitors.
  - c. Live streaming and recording.

- d. Built-in transitions and animations.
  - e. Picture-In-Picture capability.
  - f. Hard plastic protective mobile cases.
  - g. All equipment to be portable and light enough to be hand-carried in and out on game day.
- B. Display Director Video Display Software.
  - 1. WINDOWS® based video control software and laptop PC for creating and modifying messages, animations, photos, pre-recorded video and live content on large full color video displays.
    - a. Animate at up to 60 frames per second.
    - b. Supports most standard computer graphics file types (.bmp, .jpeg, .gif, .avi, mpg, mov, etc).
    - c. Message scheduling.
    - d. Include ability to control, prioritize and change graphic layouts and messages on multiple signs while allowing the user to toggle between tasks.
    - e. Include ability to allow broadcasting of live or recorded video feeds in real time.
    - f. Split displays into multiple zones for simultaneous messaging and scoring.
    - g. Sports templates for Football, Soccer, Track and Lacrosse.
    - h. Includes FinishLynx track timing interface.
    - i. Includes 30 hours of custom animation creative services provided by Nevco Creative Services.
    - j. Includes standard library of animations and graphics.
- C. OD-50DVC Outdoor Enclosure:
  - 1. Weather Proof Lockable Outdoor Enclosure Box to house Display Director Server, SP-1000 Sound System Controls and DDB T-20 AC Unit. (DDB-T20 to be included).

## 2.6 SCORING CONSOLE

- A. Nevco MPCW-7 Controller
  - 1. Capable of scoring multiple sports including football, soccer and lacrosse.
  - 2. Include remote hand switch for game clock control.
  - 3. Integrates with Display Director Software and PC.

## 2.7 IDENTIFICATION SIGNAGE

- A. Architectural Elements and Decorative Work:
  - 1. Provide custom non-Illuminated sponsor panel. Size: 24'L x 3'H

## 2.8 SPARE PARTS

- A. Supply a parts inventory containing no less than 3% spare parts for LED modules, cables and power supplies. Note: All LED modules must come from the same BIN Code as the equipment supplied.
  - 1. Manufacturer of the LED display components shall continue to make all parts necessary for the continued functioning of the system for a minimum of ten (10) years after acceptance of this project.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Site verification of conditions:
  - 1. Prior to the execution of the Work under this specification section, inspect the installed Work executed under other specification sections of this Project Manual which affect the execution of Work under this specification section.

2. Report unacceptable conditions to the Architect. Do not begin Work until unacceptable conditions have been corrected.
3. Execution of Work under this specification section shall constitute acceptance of existing conditions.

### 3.2 PREPARATION

- A. Coordination:
  1. Coordinate Work under this specification section with Work specified under other specification sections to ensure proper and adequate interface of Work specified under this specification section.
- B. Protection:
  1. Protect all adjacent surfaces from drips, spray, air pollution of surrounding environment, and other damage from work under this specification section.

### 3.3 INSTALLATION

- A. General:
  1. In accordance with manufacturer's written instructions and recommendations unless specifically noted otherwise.
  2. In accordance with approved shop drawings.
  3. Set plumb, level and square.
- B. Layout:
  1. Lines shall be straight and true.
- C. All power and electrical cables to scoreboards and displays will be routed in conduit, power to the scoreboard/display as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring will be the responsibility of contractor assigned the scoreboard equipment.
- D. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instruction. Verify unit is plumb and level.
- E. Follow manufacturer's current application requirements for installation under conditions specific to the project.
- F. Install all structural steel components in accordance with manufacturers application instructions where specified on the drawings.
- G. Excavate footings for structural supports in depths and diameters as indicated on drawings. Place concrete and reinforcing steel per EARTHWORK. Backfill section Division 31.
- H. All structural steel components shall be in accordance with ASTM A36 or A572.
  1. All Tube ends shall be covered with light gauge end caps.
  2. All new steel shall be primed and painted with a color approved by the architect.
  3. Weld steel using E70XX electrodes. Prime and paint all welds following installation.
  4. Unless otherwise specified in the drawings, all welds shall be continuous 1/4" (6mm) fillet welds.
- I. Install all electrical equipment in accordance with all federal, state and local building codes.
- J. Where manufacturer's requirements and building codes are in direct conflict, the more restrictive method of application shall prevail.

### 3.4 INSTALLATION – CONTROL CENTER

- A. Provide boxes; cover plates and jacks in locations per plans. Control cables to control panels shall be concealed.
- B. Test connect unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying and other loose accessories with Owner's designated representative.

- C. Verify earth ground does not exceed 15 ohms.

### 3.5 ADJUSTING

- A. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

### 3.6 CLEANING

- A. Clean in accordance with Specification Sections - TEMPORARY FACILITIES AND CONTROLS and PROJECT CLOSEOUT.
- B. In accordance with manufacturer's written instructions and recommendations.

### 3.7 DEMONSTRATION

- A. In accordance with Specification Section - PROJECT CLOSEOUT.
- B. Provide the services of a factory-authorized service representative to provide start-up service and to demonstrate and train Owner's maintenance personnel as specified below.
  - 1. Schedule training with the Owner's maintenance personnel with at least seven (7) days advance notice.
  - 2. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance.
  - 3. Review data in "Operating and Maintenance Manuals." Refer to Specification Section -
  - 4. PROJECT CLOSEOUT.

END OF SECTION

## SECTION 11 68 33 - ATHLETIC EQUIPMENT

## PART 1 - GENERAL

## 1.1 Section Includes

- A. Furnish and install track and field in-ground and other equipment.
- B. Furnish and install long jump pit sand, take-off boards, pit forms and pit covers.
- C. Related Sections
  - 1. Section 321313 – Site Concrete Improvements.

## 1.3 References

- A. California Community College Athletic Association (CCCAA) and the National Collegiate Athletic Association rulebooks.

## 1.4 Submittals

- A. Submit under provisions of Division 01 – Submittal Procedures.
- B. Product Data: Submit data indicating materials of construction, thicknesses/size, colors available, installation instructions. Submit jump pit sand gradation.

## 1.5 Quality Assurance

- A. Install per manufacturer's specifications.
- B. Coordinate the equipment installations with other related work.

## PART 2 - PRODUCTS

## 2.1 Materials

- A. Track And Field Equipment: Furnish and install the following track and field equipment as shown on the drawings. Approved manufactures are Gill Athletics, UCS, or approved equal.
  - 1. Sand jump pit with sand catcher on two sides: Gill Athletics Model F44023. Jump pit cover F44023C.
  - 2. Take-off board: Gill Athletics 4350S with 8" takeoff board, 4" foul board and blanking tray.
  - 3. Stainless steel vaulting box and lid: Gill Athletics 504/50401
  - 4. Steeplechase water jump form with integrated ground sleeves: Gill Athletics F610
  - 5. Ground sleeved water jump barrier: Gill Athletics 740134
  - 6. Water jump pit covers: Gill Athletics "Ready Fit Cover" F500C
  - 7. Mesh water jump barrier sleeve: Gill Athletics 740145204SP
  - 8. Track Curbing: 2" square anodized aluminum with removable sections. Gill Athletics #852A, UCS Spirit TRKCURB #792-9412

B. Long Jump Pit Sand Material:

1. Long Jump Pit Sand Material – Long jump pit sand shall be washed river sand without any organic material or debris, and shall meet the following gradation: 0 – 2mm with a maximum of 5% less than 0.20mm per weight.

PART 3 - EXECUTION

3.1 Examination

- A. Verify site conditions and notify the Owner's Representative of any conflicts with existing or proposed improvements.

3.2 Preparation

- A. Identify and mark installation locations for review prior to starting demolition or excavations.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Employ equipment and methods appropriate to the work site.

3.3 Installation

- A. Install and/or assemble per detailed drawings and in conformance with the manufacturer's installation instructions.

END OF SECTION

## SECTION 12 24 13 – SHADES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide all material, labor, equipment and series necessary to completely install all roller shades and accessories.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS
  - 2. DIVISION 01 SPECIFICATION SECTIONS
  - 3. SPECIFICATIONS IN THE FACILITY SERVICES SUBGROUP

## 1.2 REFERENCES

- A. Standards:
  - 1. ASTM American Society for Testing and Materials
  - 2. NFPA National Fire Protection Association
  - 3. WCMA Window Covering Manufacturers Association

## 1.3 SUBMITTALS

- A. Submit in accordance with specification section – SUBMITTAL PROCEDURES:
- B. Product Data:
  - 1. Submit color and type as specified by Architect.
  - 2. Submit data sheets on each piece of material being installed.
- C. Shop Drawings:
  - 1. Submit shop drawings showing fabrication and installation of the work of this section including plans, elevations, sections, details of components, and attachments to other units of work.
    - a. Include shadeband fabric orientation to rollers and their seam and batten locations.
- D. Samples:
  - 1. Provide two 6 inch square samples of proposed fabric.
  - 2. Provide aluminum finish color samples.
- E. Quality Assurance/Control Submittals:
  - 1. Test Reports:
    - a. Submit four (4) copies of Fire Test Response Characteristics.
    - b. Submit four (4) copies of No Growth when exposed to Fungi.
  - 2. Manufacturer's Written Installation Instructions.
  - 3. Statement of Installer's Qualifications.

## 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data in accordance with Specification Section – PROJECT CLOSEOUT.
- B. Operation Data in accordance with Specification Section – PROJECT CLOSEOUT.
- C. Record Documents in accordance with Specification Section – RECORD DOCUMENTS.
- D. Warranty in accordance with this specification and Specification Section – WARRANTIES.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:



- a. Roller shade must pass NFPA 701 "Fire Test Response Characteristics for small and large scale vertical burn." Materials tested shall be identical to products proposed for use.
  - b. Roller shade must possess anti-microbial characteristics and show "No Growth" per ASTM G21 "Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi."
- 2. Installer Qualifications:
  - a. Engage an experienced Installer who has successfully been in continuous business of providing and installing Roller Shade Systems and Accessories for a minimum period of five (5) years.
  - b. Completed five (5) projects of similar scope and size to that indicated for this project.
- 3. Manufacturer/Supplier Qualifications:
  - a. A company experienced in successfully producing/supplying products similar to that indicated for this project, with sufficient capacity to produce and supply required materials without causing delay in the work.
- B. In accordance with specification section – REGULATORY REQUIREMENTS.
- C. Meetings:
  - 1. Pre- Installation.....Schedule prior to the start of work.
    - a. Coordinate the work with other work being performed.
    - b. Identify any potential problems which may impede the planned progress and proper installation of work regarding quality of installation and warranty requirements.
  - 2. Progress:.....Scheduled by the Contractor during the performance of the work.
    - a. Review for proper installation of work.
    - b. Inspect and identify any problems and acceptable corrective measures.
    - c. Identify any measures to maintain or regain project schedule if necessary.
  - 3. Completion:.....Scheduled by the Contractor upon proper completion of the work.
    - a. Inspect and identify any problems which may impede issuance of warranties.
    - b. Maintain installed work until the Notice of Substantial Completion has been executed.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
  - 1. Products shall be individually wrapped and in factory packages.
  - 2. Products shall be handled in such a manner as to assure that they are free from dents, tears, and other damage.
  - 3. Shadeband fabric shall be protected from snagging, soil, and other damage. In the event that fabric suffer damage, the fabricator shall clean, repair or replace at no additional expense.
- B. Acceptance at Site:
  - 1. Products must be in manufacturer's original unopened packaging with labels indicating manufacturer, product name, and location for installation using same designation indicated on drawings.
  - 2. Damaged product will not be accepted.
  - 3. Products shall not be delivered to the project site until the area is ready for installation.
- C. Storage and protection
  - 1. Products shall be stored in a dry protected area.
    - a. Cover materials with protective waterproof covering providing for adequate air circulation and ventilation.

## 1.7 PROJECT CONDITIONS

- A. Existing conditions:

1. Examine project site and building(s) and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Verify actual dimension of openings and construction contiguous with the roller shades by field measurements before fabrication.

#### 1.8 WARRANTY

- A. Contactor's General Warranty:
  1. In accordance with specification section – WARRANTIES.
- B. Manufacturer's Warranty:
  1. In accordance with manufacturer's written standard warranty.
- C. Hardware System and Shadebands: 10 years.
- D. Installer's Warranty: 1 Year.
  1. In accordance with the terms of the specification section- WARRANTIES.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Furnish a complete and operational shade system with accessories necessary for operation including brackets, operating mechanisms, rollers, couplers, shadeband, mounting hardware, and fasteners.
- B. Provide shade hardware that allows for the removal of shade roller tubes from brackets and center supports without removing hardware from opening.
- C. Provide shade hardware required to support 150 percent of the full weight of each shade.
  1. Hardware shall be corrosion resistant.
- D. Provide positive mechanical engagement of drive mechanism to shade roller tube.
- E. Roller Tube shall be extruded aluminum of a diameter and wall thickness required to support shade fabric without deflection.
  1. Shadeband attachment to Roller Tube: [Manufacturer's standard method.] [Removable spline fitting integral channel in tube.]
    - a. Shade hardware shall allow for the removal and re-mounting of shadeband without having to remove the shade tube from operating mechanism or support brackets.
  2. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  3. Direction of Shadeband Roll shall be [Regular, from back of roller]
- F. Roller-Coupling Assemblies shall be coordinated with operating mechanism and designed to join up to three in line rollers into a multiband shade that is operated by one roller drive-end assembly.

#### 2.2 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with specification section – SUBSTITUTION PROCEDURES.

## 2.3 SHADEBAND

- A. Specified Shadeband product manufacturer, or approved equivalent:
  - 1. MECHOSHADE SYSTEMS INC., Long Island City, New York
  - 2. Acceptable alternative manufacturers:
    - a. DRAPER INC., Spiceland, Indiana
    - b. HUNTER DOUGLAS CONTRACT, Nysan Solar Control, Poway, CA
- B. Light-Filtering Fabric (Type 1) to occur at Exterior Windows only:
  - 1. Manufacturer: MECHOSHADE SYSTEMS INC.
  - 2. Product Name: SoHo 1600 Series
  - 3. Product Color: 1603 Light Grey
  - 4. Physical Characteristics:
    - a. Type: 76% PVC, 24% Polyester
    - b. Weave: 2x2 Basket Weave
    - c. Thickness: 0.024 inches
    - d. Weight: 13.50 oz/sq yd.
    - e. Openness Factor: 3 percent
    - f. Maximum Roll Width: As wide as available to minimize seams.
  - 5. Performance Characteristics:
    - a. Flame Retardant meets NFPA 701
    - b. GreenGuard Indoor Air Quality Certified
  - 6. Refer to drawings and schedule for locations.
- C. Blackout Fabric (Type 2) to occur at Interior Windows only:
  - 1. Manufacturer: MECHOSHADE SYSTEMS INC.
  - 2. Product Name: Classic Classic Blackout 0700 Series.
  - 3. Product Color: 0702 Light Grey
  - 4. Physical Characteristics:
    - a. Type: 73% Vinyl Coating, 27% Fiberglass
    - b. Weave: Mesh.
    - c. Thickness: 0.013 inches.
    - d. Weight: 12.50 oz/sq. yd.
    - e. Openness Factor: 0 percent.
    - f. Maximum Roll Width: 72 inches.
  - 5. Performance Characteristics:
    - a. Flame Retardant meets NFPA 701
    - b. GreenGuard Indoor Air Quality Certified
  - 6. Refer to drawings and schedule for locations

## 2.4 MANUAL SHADE SYSTEM

- A. Provide MECHOSHADE SYSTEM Mecho/5.
  - 1. Specified Manual Shade System product manufacturer:
    - a. MECHOSHADE SYSTEMS INC., Long Island City, New York
    - b. Acceptable alternative manufacturers:
      - 1) DRAPER INC., Spiceland, Indiana
      - 2) HUNTER DOUGLAS CONTRACT, Nysan Solar Control, Poway, CA
- B. Provide Chain and Clutch operating mechanism with continuous-loop bead chain and clutch that stops shade movement when bead chain is released.
  - 1. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  - 2. Bead chains shall be #10 stainless steel with upper and lower limit ball stops.
    - a. Chain retainer type: [Chain Tensioner]
    - b. Loop length shall be [full length of shade]
  - 3. Provide manufacturer's standard Spring Lift Mechanism for shadebands that weigh more than 10 lbs.

## 2.5 ACCESSORIES

- A. Front Fascia:
  - 1. Provide L-shaped aluminum extrusion to conceal roller, shadeband and operating mechanism and attaches to roller endcaps without exposed fasteners.
- B. Endcap Covers:
  - 1. Provide aluminum extrusion to cover endcaps and match Front Fascia.
- C. Exposed Headbox:
  - 1. Provide extruded aluminum rectangular enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

## 2.6 FABRICATION

- A. Shadebands:
  - 1. Fabricate manual shade system to comply with WCMA A100.1 for requirements relative to flexible chain-loop devices.
  - 2. Fabricate units in sizes to fill window and other openings as follows, measured at 74 degrees Fahrenheit.
    - a. Inside Jamb installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch. Length equal to head-to-sill or –floor dimension of opening in which shade is installed less 1/4 inch , plus or minus 1/8 inch.
    - b. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end –to-end installations at centerlines of mullion or other defined vertical separations between openings.
  - 3. Fabricate shadebands without battens or seams to extent possible except as follows:
    - a. At vertical shades where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacing's along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
    - b. Railroad material where roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroad material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.
    - c. Battens, when required or indicated, shall be concealed in an integrally-colored fabric to match the inside and outside colors of the shadeband.
      - 1) Battens shall be roll-formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
  - 4. Fabricate shadebands to hang flat without buckling or distortion.
  - 5. Fabricate bottom hem with hem weights.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verification of conditions:
  - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other sections of this Project Manual which affect the execution of work under this specification section.
  - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
  - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.

**3.2 PREPARATION****A. Coordination:**

1. Before proceeding, verify plans match existing conditions.
2. Review documents of existing construction provided by Owner against existing conditions.
3. If conflicts are encountered, report it to the Architect. Then prepare recommendation(s) for correction and submit to Architect for review.
4. Coordinate work under this specification section with work specified under other sections.

**B. Protection:**

1. Protect all adjacent surfaces from potential damage from work under this specification section.

**C. Surface Preparation:**

1. Prepare surface in accordance with manufacturer's instructions and recommendations.

**3.3 INSTALLATION****A. General:**

1. In accordance with manufacturer's instruction and recommendations unless specifically noted otherwise.
2. In accordance with approved submittals.
3. In accordance with regulatory requirements.
4. Set plumb, level, and square and align with adjacent units as indicated.
5. Allow proper clearances for window operation hardware.
6. Locate shadeband to be no closer than 2 inches to interior face of glass.
7. Connect motor-operated shades to building electrical system.

**3.4 ADJUSTING****A. Adjustment:**

1. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

**3.5 CLEANING****A. Clean in accordance with specification section – PROJECT CLOSEOUT:**

1. Immediately clean any soiled surfaces to remain.
2. After installation clean in accordance with manufacturer's instructions and recommendations.

**3.6 DEMONSTRATION****A. In accordance with specification section – PROJECT CLOSEOUT.**

1. Engage a factory authorized representative to train owner's maintenance personnel to adjust, operate, and maintain shade systems.
2. Schedule training with seven days of advance notice.

END OF SECTION

## SECTION 22 00 00 – PLUMBING

## PART 1: - GENERAL

## 1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 23 00 00, shall form a part of this Section with the same force and effect as though repeated here.

## 1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
  - 1. Sanitary sewer system.
  - 2. Domestic water system.
  - 3. Storm drain system.
  - 4. Fuel gas system.
  - 5. Drain system (including condensate drain).
  - 6. All equipment as shown or noted on the drawings or as specified.
  - 7. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.
  - 8. Lead Free: All equipment, fixtures, valves and fixture stops providing water for human consumption installed after January 1, 2010, must meet the “Lead Free” requirements for the State of California.
- B. Work Specified Elsewhere:
  - 1. Line voltage power wiring, disconnect switches and installation of all starters are included in the Electrical Section unless otherwise noted.
  - 2. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
  - 3. Painting unless specifically called for in the drawings or specifications.
  - 4. Carpentry.
  - 5. Control of circulating pumps, etc.

## PART 2: - PRODUCTS

## 2.1 PIPING MATERIALS:

- A. Sanitary Sewer:
  - 1. Soil, Waste and Vent Piping (Non-Pressurized) - Inside Building, Within Five Feet of Building Walls to Civil P.O.C.: Standard weight coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888, or hub end with rubber gaskets, ASTM A74, ASTM C564. ABI, Charlotte, Tyler. Couplings shall be heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C-1540. Husky HD 2000, Clamp-All 80, Mission HeavyWeight. MG Couplings are also acceptable. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12.

2" and smaller exposed to view shall be galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12. Fixture and equipment drains exposed to view in kitchens shall be DWV copper, recessed drainage fittings, 95-5 solder.

**Where required by soil conditions, as determined by the method described in ASTM A74-09, Appendix X2, below grade cast iron pipe and fittings shall have 8 mil (minimum) Polyethylene Encasement (Poly Wrap), Per ANSI/AWWA C105/A21.5.**

2. Cleanouts: Comparable models of Josam, Wade, Mifab or Zurn are acceptable. Grease plug prior to installation. Floor Cleanouts: Smith 4023 with nickel bronze top in finished areas; Smith 4223 in utility areas. Wall Cleanouts: Smith 4532 with stainless steel cover and screw. Pipe Cleanouts: Iron body with threaded brass plug. Site cleanouts more than 5' outside building may be PVC with PVC plug.
  3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F8 in foot traffic areas; G5 in roadways. Provide with PVC pipe extension down to top of pipe.
- B. Storm Drain (Including Rain Water Leader, RWL) - Inside Building and Within Five Feet of Building Walls to Civil P.O.C.: Same as Soil, Waste and Vent Piping, except as otherwise noted on drawings. Where exposed to view on exterior of building, piping shall be galvanized steel with recessed drainage fittings.
- C. Water, and Gas:
1. Hot and Cold Water Piping - Inside Building, Within Five Feet of Building Walls to Civil P.O.C., and All Above Grade: Materials used in the water system, except valves and similar devices, shall be of like material, except where otherwise approved by Engineer and Authority Having Jurisdiction, prior to start of work.
    - a. Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, lead-free solder. All nipples shall be lead-free red brass (85% copper). Branch piping from the cold water main above the ceiling to roof mounted hose bibbs shall be type "K" copper. Above grade fittings may be copper press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer's installation instructions. ProPress, Apollo, Mueller Streamline.
  2. Gas Piping:
    - a. Inside Building and All Above Grade: 2" and Smaller: Schedule 40 galvanized steel pipe, ASTM A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Flexible connections shall be corrugated stainless steel, CSA (US) approved. 2-1/2" through 4": May be screwed pipe as above or welded pipe as below. 6" and larger: Schedule 40 black steel pipe, ASTM A53. Standard weight carbon steel welding fittings, long radius ells, ANSI B16.9.
    - b. Inside Building - Below Grade to Five Feet Outside Building: Same as Inside Building and All Above Grade. Provide sleeves and vents acceptable to administrative authority.
    - c. Outside Building - Below Grade: Polyethylene pipe and fittings, ANSI B31.8, ASTM D2513, where allowed by administrative authority,

Driscopipe 6500, Dupont Aldyl "A", Plexco. Otherwise, piping shall be coated schedule 40 steel, ASTM A53.

3. Valves and Specialties:

a. Valves:

- (1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Kitz, Milwaukee, Nibco, Stockham, Walworth or Watts are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. Butterfly valves may be substituted for 2-1/2" and larger gate valves above grade; see specification below. Provide a minimum of two operating "T" handles for underground valves for each underground system where valves are required. The lengths of the handles are dependent upon the depth of the valves and the ability of the handles to fully open and/or close the valves. At least one "T" handle for each system shall be on site at the beginning of the installation of a particular system for emergencies, and the Construction Manager shall have access to these "T" handles and valves.
- (2) Gate Valve: 2" and Smaller: All bronze. Non-rising stem. Threaded bonnet. Wedge disk. Malleable iron handwheel. 200 psi CWP. Nibco T-113-LF. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Resilient wedge. 200 psi CWP. Flanged or AWWA hub end as applicable. Nibco F-619-RWS. Underground valves shall have square operating nut.
- (3) Butterfly Valve: Ductile iron threaded lug body. Aluminum bronze disk. EPDM molded-in liner and seals. 416 stainless steel shaft. 6" and smaller valves shall have multi-position lever handle. 8" and larger valves shall have gear operator. Provide 2" extension neck at insulated pipes. Nibco LD-2000.
- (4) Check Valve: 2" and Smaller: Lead-free bronze swing check, regrinding. 200 psi CWP. Nibco T-413-Y-LF. For vertical applications use lead-free bronze, spring-loaded, lift-type. Nibco T-480-Y-LF.
- (5) Ball Valve: Full port. Lead free brass body, cap, stem, disk and ball. Screwed connection. Lever handle. PTFE seat and stem packing. Min. 400 psi CWP. CSA-US and UL listed. Nibco T-FP-600A-LF.
- (6) Plug Valve: Valves in gas piping systems must be UL or CSA listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. KeyPort Valve Series 400. 2" and smaller above grade may be listed full port ball valves, except in publically accessible locations. Apollo, Jomar, Nibco. 6" and Larger: Lubricated plug cock. Cast iron or semi-steel body and plug. 200 psi WOG. Flanged. Wrench handle. Provide one operating "T" handle for underground valves. Resun R-1431.
- (7) Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F8 in foot traffic areas; G5 in roadways. Provide with PVC pipe extension down to top of pipe.

b. Instruments:



- (1) Thermometer: 3" dial. Stainless steel case. Back or bottom connected as required. 1/2" NPT. 20F-240F, 2F divisions for hot water. 25F-125F, 2F divisions for chilled water. 2" insertion length. Allowance to be made for insulation thickness. For installations over 7 feet above finish floor, provide digital thermometer with remote reader. Marshalltown, Moeller, Taylor, Tel Tru, Winters.
  - (2) Thermometer Well: Brass well. Suitable for thermometer above. Provide 2" extension at insulated pipes.
- c. Miscellaneous Specialties:
  - (1) Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
  - (2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Unions for copper piping shall be copper or lead free cast bronze. Anvil. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. EPDM gasket, NSF 61 rated. Victaulic Style 77, Gruvlok.
  - (3) Dielectric Coupling: Insulating union or flange rated for 250 psig. Wilkins DUXL Series.
  - (4) Shock Absorber: Multiple bellows. All stainless steel construction. Designed and applied in accordance with PDI WH201. Amtrol, Smith, Wade, Zurn.
  - (5) Gas Pressure Reducing Valve: Capacity and pressure ratings as indicated on drawings. American Meter.
  - (6) Flexible Connection: Corrugated bronze or stainless steel core covered with high tensile bronze or stainless steel tubular braid. 150 psi working pressure. 2" and smaller shall have screwed connections. 2-1/2" and larger shall have flanged connections. Flexonics, Keflex.
- D. Drain Piping (including Condensate): Same as inside building cold water piping.
  1. Condensate Drain Piping for Condensing Gas Fired Equipment: Schedule 40 CPVC piping with solvent weld fittings from equipment to neutralizing kit. Schedule 40 galvanized steel, ASTM A53 downstream of neutralizing kit. If no neutralizing kit, piping shall be CPVC to point of discharge.
- E. Flue and Intake Piping (Condensing Gas Fired Equipment): Polypropylene pipe, vent and fittings, ASTM D4101. Flame retardant in accordance with ASTM D635 and UL 94. Schedule 40. Fusion or mechanical joints above grade. Enfield, Orion.
- F. Miscellaneous Piping Items:
  1. Pipe Support:
    - a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Anvil, Unistrut.

- b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.
  - c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Anvil, Unistrut.
2. Flashing: Vent flashing shall be 4 lb/ft<sup>2</sup> lead, 16" sq. flange, length sufficient to be turned down 2" into vent. Oatey. Flashing for other piping through roof shall be prefabricated galvanized steel roof jacks with 16" sq. flange. Provide clamp-on storm collar and seal water tight with mastic. For cold process built-up roof, material shall be 4 lb/ft<sup>2</sup> lead instead of galvanized steel. For single-ply roofing, use the roofing manufacturer's recommended flashing material.

## 2.2 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft<sup>2</sup>-F at a mean temperature of 50F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping to 140°F, thickness shall be 1" for pipe sizes less than 1"; 1-1/2" thickness for pipe sizes 1" and larger. See Title 24, Part 6 "California Energy Code" for temperatures above 140°F. Knauf, Johns-Manville, Owens-Corning.
- C. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft<sup>2</sup>-F at a mean temperature of 50F. 1-1/2" thickness. Knauf, Johns-Manville, Owens-Corning.
- D. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.
- E. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe. 0.024" thickness for fittings. Integral moisture barrier. Stucco-Embossed finish. Provide pre fabricated aluminum strapping and seals by same manufacturer. ITW or RPR.
- F. Outdoor Weather Barrier Mastic: Childers CP-10/11, Foster 46-50.
- G. Metal Jacketing Sealant: Childers CP-76, Foster 95-44 (gallon can quantities only; no tubes).
- H. Molded Closed Cell Vinyl (Piping Insulation Under Accessible Lavatories and Sinks): Fully molded closed cell vinyl, 1/8" thick, minimum. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft<sup>2</sup>-°F at an average temperature of 73°F. Weep hole in cleanout nut enclosure. Hinged cap over valve to allow access for servicing. Out of sight nylon fastening

system and internal ribs on drain insulation to provide air gap (Lav-Guard Only). Truebro Lav-guard, McGuire Pro Wrap, Plumberex.

### 2.3 FIXTURES:

- A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.
- B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Eljer, Elkay, Haws, Just, Kohler, T&S Brass, Willoughby or Zurn are acceptable. For drainage fixtures, equivalent models of Josam, Mifab, Smith, Wade or Zurn are acceptable.
- C. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.
  - 1. Stops: All hot and cold water supplies shall be 1/2" I.P.S. inlet angle stops with stuffing box, loose key lock shield, and brass riser (3/8" for 2-1/2 gpm and less, otherwise 1/2"). McGuire, Speedway.
  - 2. P-Traps: Semi-cast brass, ground joint. 17-gage. Clean-out plug. Unobstructed waterway. California Tubular, McGuire.
- D. Caulking: Caulk fixtures with white G.E. "Sanitary SCS1700", mildew resistant silicone sealant with EPA listed anti-microbial.

### 2.4 EQUIPMENT:

- A. General Requirements:
  - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
  - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
  - 3. Ratings:
    - a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and shall be CSA (US) or AGA certified.
    - b. Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established.
  - 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

## 5. Electrical:

- a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, and shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
- b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
- c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip-proof, NEMA B design on pumps, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction, unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors from 1 horsepower to 5 horsepower shall be the standard high efficiency type, Magnetek E-Plus. Motors 7-1/2 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Vertical motors with exposed fans shall have rain caps.
- d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
- e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
- f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

- B. Water Heater: Gas fired. Minimum 95% thermal efficiency. Water heater(s) shall be of power direct vent design, using polypropylene pipe for horizontal and/or vertical vent runs. Water heater(s) shall have seamless, glass-lined steel tank construction and a spiral-shaped heat exchanger placed entirely inside the tank, which shall be glass-lined on the flue gas side to protect against acidic condensate. Advanced electronic control w/ LCD display and actual diagnostic. Water heater(s) shall meet the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1 and be design-certified by CSA or UL (Underwriters Laboratories) according to ANSI Z21.10.3-CSA 4.3 standards governing storage tank water heaters. Water heater shall comply with SCAQMD Rule 1146.2 and other Air Quality Management Districts with similar requirements for low NO<sub>x</sub> emissions. Water heater shall incorporate the iCOMM™ system connection for remote monitoring, leak detection and fault alert. Powered non-

sacrificial anodes. Neutralizing kit. Energy Star qualified. 5-year extended warranty. A.O. Smith.

- C. Circulating Pump: In-line centrifugal. 3-speed motor. Body: Lead Free bronze body, brass impeller. Mechanical seals. Bronze sleeve bearings. Integral thermal overload protection. Bell and Gossett/Xylem, Taco. -OR- Body: Aluminum housing. All parts exposed to fluid, stainless steel. Water lubricated ceramic shaft and bearings. Epoxy encapsulated windings. Grundfos.
- D. Electric Drinking Fountain: Wall hung with bottle filler, see equipment schedule on plumbing drawings. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self-closing valve. Non-ferrous evaporator. Lead solder shall not be used. Hermetic compressor with automatic reset overload protection. Air cooled condenser. Adjustable thermostat. UL listed. ARI certified. Elkay, Haws, Sunroc.

### PART 3: - EXECUTION

#### 3.1 PIPING INSTALLATION:

- A. General:
  - 1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted.
  - 2. Joints:
    - a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
    - b. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
    - c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
    - d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.
  - 3. Fittings and Valves:
    - a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.

- b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
  - c. Unions: A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
  - d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.
  - e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed within 24" of the ceiling. For situations where this is not practical or where valves are greater than 10' above the floor, chain wheel operators shall be provided. Chain shall extend down to 7' above the floor. All such installations must have prior review by the Engineer.
4. Pipe Support:
- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Nibco 707-3-5, to a Holdrite Model #SB1 bracket; nipple through surface shall be threaded brass.
- (1) Pressure Pipe:

Pipe Size (Inches)	Maximum Spacing* Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4
6	10	10	4
8	10	10	4

\*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.

- (2) Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.
  - b. Hot and Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.
  - c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
- 5. Miscellaneous:
  - a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
  - b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance.
  - c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.
  - d. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.
  - e. Thermometer Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2". Mount on side of pipe.
- B. Sanitary Sewer Piping:
  - 1. General: Where inverts are not indicated, piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.
  - 2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.
  - 3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10' of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2' minimum from gutters, parapets, ridges and roof flashing.
- C. Storm Drain (Including Rain Water Leader, RWL): Similar to Sanitary Sewer. Piping with less than 24" of cover outside building walls shall be cast iron.
- D. Water Piping: Connections to branches and risers shall be made from top of main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Minimum pipe size shall be 1/2", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Shock absorbers shall be installed in a vertical position as indicated on drawings. Only equipment mounted on vibration isolators shall be connected with flexible connections.

- E. Gas Piping: Installation shall comply with CPC and NFPA 54 (National Fuel Gas Code). Shall be pitched to drain to drip legs at low points where other than dry gas conditions exist. No unions shall be installed except at connections to equipment. Provide shutoff and dirt leg (sediment trap) at each equipment connection. Only equipment mounted on vibration isolators shall be connected with flexible connectors. Under floor piping shall be sleeved and vented. Plastic pipe and fittings shall be joined in accordance with manufacturer's recommendations. Metal to plastic transition fittings shall be installed at all transitions. Provide 14-gage insulated tracer wire secured to pipe at 10' intervals with nylon ties. Terminate tracer 6" above grade at both ends.
- Odor Fade Warning – The odorant in propane (LP) and natural gas is colorless and the intensity of its odor can fade under some circumstances. Contact the utility company for more information.**
- Submit installer training certification from polyethylene piping manufacturer certified trainer, include copy of trainer's certification. Training shall have been completed no more than 6 months prior to starting work.
- F. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass, except in equipment rooms, piping shall be galvanized steel. P&T relief and water heater drain piping shall be galvanized steel. Provide secondary drain piping where required.
- G. Plastic Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

### 3.2 PIPING INSULATION INSTALLATION:

- A. Domestic Hot Water:
1. General: All domestic hot water piping, fittings and accessories shall be insulated.
  2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.
  3. Fittings and Valves:
    - a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with 1-1/2" (min.) overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140F or the piping is exposed to weather.
    - b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the fiberglass blanket with stretchable glass fabric, one coat of lagging adhesive and a final coat of



vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

4. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.
- B. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather or other areas subject to freezing (i.e. ventilated attics, uninsulated exterior soffits, etc.) shall be insulated same as hot water piping. Cover with PVC jacketing where exposed to view, aluminum jacketing where exposed to weather.
- C. Piping Insulation Under Accessible Lavatories and Sinks: Water piping, water stops and drain piping under accessible lavatories and sinks shall be insulated with 1/8" thick molded closed cell vinyl. Installation shall be in accordance with manufacturer's instructions.

### 3.3 FIXTURE INSTALLATION:

- A. Fixture Height: Shall be as indicated on Architectural drawings.
- B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all foreign matter out of drain line.
- C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- D. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk floor mounted fixtures with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

### 3.4 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment. All equipment shall be securely anchored in place.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

### 3.5 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense,

uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.

B. Gravity Systems:

1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
2. Drains (Including Condensate): Similar to Sanitary Sewer.
3. Storm Drain: Similar to Sanitary Sewer.

C. Pressure Systems:

1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.
2. Domestic Hot and Cold Water Piping: Maintain 100 psig water pressure for 4 hours.
3. Gas Piping: Maintain 100 psig air pressure for 4 hours.
4. Backflow Preventer: All backflow preventers shall be tested according to manufacturer's recommendations and the USC Cross Connection Control and Hydraulic Research Manual (8th Edition). Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall certify in writing to the Architect the date which backflow preventers were tested and by whom test was witnessed.

3.6 DISINFECTION:

- A. Disinfect all domestic water piping in accordance with 2022 CPC Section 609.10, and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, one set of water samples shall be collected by Contractor for bacteriological analysis in presence of Inspector. If the water fails the bacteriological test, Contractor shall disinfect the piping again and pay for any retesting required, at no additional cost to owner. Bacteriological testing results shall be obtained by Contractor and delivered to the Owner through the Architect before project completion. Contractor shall include copy of Bacteriological Test Results at closeout with operation and maintenance manuals.

END OF SECTION



SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1: - GENERAL

1.1 GENERAL CONDITIONS:

- A. The preceding General and Special Conditions and Divisions 00 and 01 requirements shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall apply to all of the Sections of Divisions 22 and 23 of these Specifications and shall be considered a part of these sections.

1.2 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of all applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:
  - 1. California Code of Regulations (CCR):
    - a. Title 8, Industrial Relations
    - b. Title 24, Part 1, Administrative Regulations
    - c. Title 24, Part 6, California Energy Code, 2022 Edition
    - d. Title 24, Part 11, California Green Building Code, 2022 Edition
  - 2. California Building Code - CBC - 2022
  - 3. California Mechanical Code - CMC - 2022
  - 4. California Plumbing Code - CPC - 2022
  - 5. California Fire Code - CFC - 2022
  - 6. California Electrical Code - CEC - 2022
  - 7. Air Diffusion Council - ADC
  - 8. American Gas Association - AGA
  - 9. Air Movement and Control Association - AMCA
  - 10. American National Standards Institute - ANSI
  - 11. Air Conditioning and Refrigeration Institute - ARI
  - 12. American Society of Heating, Refrigerating, and Air Conditioning Engineers - ASHRAE
  - 13. American Society of Mechanical Engineers - ASME
  - 14. American Society for Testing and Materials - ASTM
  - 15. American Water Works Association - AWWA
  - 16. Cast Iron Soil Pipe Institute - CISPI
  - 17. National Electrical Manufacturers Association - NEMA
  - 18. National Fire Protection Association - NFPA
  - 19. National Sanitation Foundation - NSF
  - 20. Occupational Safety and Health Act - OSHA
  - 21. Plumbing and Drainage Institute - PDI
  - 22. Sheet Metal and Air Conditioning Contractors National Association - SMACNA
  - 23. Underwriters' Laboratory - UL

1.3 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as part of the work included under each system. All charges or fees for service connections, meters, etc. shall be included in the work.

1.4 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements. Verify the proper voltage and phase of all equipment with the electrical plans. If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Architect and the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination.
- B. Mandatory Coordination and Shop Drawings:
  - 1. Prepare or have prepared high level detailed Shop Drawings in plan view, with cross-sections as necessary, indicating the proposed installation plan for all HVAC, mechanical, fire sprinkler, and plumbing installations for the project. These Drawings should depict actual elevations and linear dimensions, as well as all routing changes, transitions, major offsets, deck and structural attachments deemed necessary to accomplish the installation. Individual Shop Drawings may be prepared for each trade working within the designated space or area; however, the coordination of the consolidated installation shall remain the responsibility of the Contractor. These Shop Drawings shall be provided to each Subcontractor having Work in each area for coordination. Any fittings, offsets or other changes due to coordination shall be at no additional cost to Owner.
  - 2. Whereas the Drawings are diagrammatic, showing only the general arrangement of the systems, Contractor shall have responsibility for the fitting of materials and equipment to other parts of the equipment and structure, and to make adjustments as necessary or required to resolve space problems, preserve service room, and avoid architectural and structural elements and the Work of other trades. Contractor may be required to identify certain areas to relocate installations within the spaces depicted on the Drawings, e.g., ductwork and/or piping may be shifted within the space shown to accommodate other systems. Such functional relocations shall not be deemed a change to the requirements of the Contract. In the event a major re-routing of a system appears necessary, Contractor shall prepare and submit for approval, Shop Drawings of the proposed rearrangement.
  - 3. Because of the diagrammatic nature and small scale of the Drawings, all necessary offsets, adjustments, and transitions required for the complete installation are not shown. Contractor shall carefully investigate the conditions affecting all the Work and shall arrange such Work accordingly, furnishing such fittings, equipment, valves, accessories, offsets, etc., as may be required, regardless of size or cost, to meet such conditions, at no additional cost to the Owner.

4. Coordination changes are not design changes and shall be provided at no additional cost to Owner. Any guidance, drawing or clarification issued by the Architect or Engineer to assist the Contractor or their sub-contractors in their coordination during construction are not design changes and shall be provided at no additional cost to Owner.
5. Resolve differences or disputes between subcontractors and materials suppliers concerning coordination, interference, or extent of work between sections. The Contractor's decisions, if consistent with the Contract Documents, shall be final. The Architect and their Consultants are not required to coordinate work between sections and will not do so. Any changes required that affect the design intent shall be presented to and approved by the Architect and Engineer of Record.
6. The coordinated Shop Drawings must be signed off by HVAC, Plumbing, Fire Sprinkler, Electrical, Framing, Ceiling Installation, and Data and Low Voltage Subcontractors.
7. The signed off Shop Drawings shall be submitted to the Owner's Representative for review and approval prior to commencement of installation.
8. Provide reviewed Shop Drawings to each Subcontractor having Work in each area.

1.5 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Architect. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.

1.6 QUIETNESS:

- A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.7 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.8 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.9 COMPATIBILITY WITH EXISTING SYSTEMS:

- A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.10 MATERIALS AND EQUIPMENT:

- A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance.

1.11 SUBMITTALS:

- A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project (this includes deferred approval items). Material or equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution.

All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.
2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on drawings.
3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.
4. Drawings shall be submitted in both hard copy and electronic form, electronic files shall be in their native format (i.e. DWG for AutoCAD, RVT for Revit, etc).
5. Electronic Submittals: Where allowed by Division 01, electronic submittals are acceptable providing the following requirements are met. Electronic submittals which do not comply with these requirements will be rejected.
  - a. Submittal shall be a single file in PDF format, with bookmarks for table of contents and each tab, and sub-bookmarks for each item.
  - b. All text shall be searchable (except text that is part of a graphic).
  - c. Submittal shall include all items noted in 1 through 3 above, except a binder is not required.
  - d. Electronic submittals shall be processed through normal channels. Do not submit directly to the Engineer unless the Engineer is the prime consultant for the project.

- e. Contractor shall provide Owner and Owner's Representative with hard copies of the final submittal. Coordinate exact number required with Owner through Architect/Engineer.

B. Substitutions:

1. Manufacturers and model numbers listed in the specifications or on the drawings establish the size, standard of quality, features and function selected by the Engineer for this Project. Alternate manufacturers may be submitted for review by the Engineer as allowed by Section 01 33 00 "Submittal Procedures" or Section 01 25 00 "Substitution Procedures", as applicable. If the alternate manufacturers are not approved, then the Contractor shall submit product specified. Calculations and other detailed data indicating how the item was selected shall be included.
2. Due to the complexity of mechanical equipment, features and functions, where equipment is scheduled on the drawings, any equipment submitted other than scheduled equipment is considered a substitution, and shall comply with the requirements of Section 01 25 00 "Substitution Procedures". It is understood that because of this complexity, subsequent reviews of Substitution Requests may be unavoidable. The Mechanical Engineer waives the fees identified in Section 01 25 00, for the initial and first subsequent review of a Substitution Request for mechanical equipment scheduled on the Drawings.
3. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.

- C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.12 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance.



Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.13 SCHEDULING OF WORK:

- A. All work shall be scheduled subject to the review of the Architect, Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner.

1.14 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Architect.

1.15 EXCAVATION AND BACKFILL:

- A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.
- B. Excavation: Width of trenches at top of pipe shall be minimum of 16", plus the outside diameter of the pipe. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.
- C. Backfill:
  - 1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator. Native soil may be used where allowed by Geotechnical (Soils) Report. Where native soil is used, trenching for gravity drain pipe shall be done using a laser-level and trencher.
  - 2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.

- D.      Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100' of trench.

1.16    PROTECTIVE COATING FOR UNDERGROUND PIPING:

- A.      All metal pipe below grade shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru-Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Johns-Manville. Protective coating shall be extended 6" above surrounding grade.

1.17    ACCESS DOORS:

- A.      Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Key and cylinder lock (except quick-opening type for Emergency Gas Shutoff Valve). Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

1 valve up to 1-1/2"	12" x 12"
1 valve up to 3"	16" x 16"

1.18    HOUSEKEEPING PAD:

- A.      Housekeeping pads shall be 6" high concrete, 3000 PSI strength, unless otherwise noted. Pad shall extend 6" beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the pad shall have a 3/4" chamfer. The pad shall have #4 reinforcing bars at 12" on center, each way, located at the mid-depth of the pad. If not poured at the same time as the floor slab with pad rebar tied to floor rebar, the pad shall be anchored as follows: Drill 1" diameter, 4" deep hole in floor. Fill hole with "Por-Rok", then insert 8" long, #4 rebar into hole. Provide a minimum of 4 of these anchors per pad, but no more than 4 feet apart in either direction. Anchor points shall be 12" from the edge of the pad.

1.19    CONCRETE ANCHORS:

- A.      Steel bolt with expansion anchor requiring a drilled hole - powder driven anchors, adhesive anchors and concrete screws are not acceptable. Re-use of screw anchor holes shall not be permitted. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete. Post-installed anchors in concrete used for component anchorage shall be pre-qualified for seismic application in accordance with ACI 355.2 and ICC-ES AC193. Post-installed anchors in masonry used for component anchorage shall be pre-qualified for seismic applications in accordance with ICC-ES AC01. Maximum allowable loads for tension and shear shall be as determined by Calculation in compliance with ACI 318-14, Chapter 17, and the anchor's ICC or IAPMO evaluation report. Hilti, Powers, Red Head.

1.20 EQUIPMENT ANCHORING:

- A. All equipment shall be securely anchored in accordance with ASCE 07-16, Chapter 13, as amended by CBC Section 1617A.1. All equipment mounted on concrete shall be secured with a concrete anchor as shown on drawings at each mounting point.

1.21 SEISMIC SUPPORT AND RESTRAINT DESIGN SERVICE:

- A. All mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the "Seismic Restraint Components for Suspended Utilities", 2022 Edition, as published by Mason West Inc., OPM-0043-13, or other HCAI pre-approved system, and in accordance with ASCE 07-16, Chapter 13, as amended by CBC Section 1617A.1. Brace spacing shall be reduced by 50% for cast iron, plastic, no-hub, or other non-ductile piping. A copy of this manual shall be kept on site at all times during construction.
- B. Contractor shall obtain the services of a Seismic Design service to provide engineered seismic supports and restraints for the project. Mason Industries, or pre-approved equal.
  - 1. All seismic designs, including designs using HCAI pre-approvals, shall be submitted as project specific engineered designs sealed and signed by a licensed California structural engineer. All seismic designs shall include project / application specific seismic design demand calculations. Said seismic design demand calculations shall account for seismic forces in all applicable direction including axial, lateral, vertical tension, vertical compression, etc. Designs shall account for prying, eccentricity, uneven loading, weak axis bending, etc.
  - 2. Seismic restraint layouts for piping, ductwork and electrical raceways shall be furnished on shop drawings or added to the contractor's shop drawings and shall include:
    - a. The number, size and location of seismic braces.
    - b. Maximum support loads and seismic loads at the seismic brace locations.
    - c. Reference to specific details or pages from the HCAI pre-approved system (OPM).
  - 3. Installations not addressed by the OPM approval must be designed, detailed and submitted along with the shop drawings.
  - 4. Submit seismic restraint layout drawings and special details for approval of the project structural engineer per the requirements listed in the HCAI pre-approval (OPM).
  - 5. Seismic restraint layout drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of California who designed the layout of the braces.

1.22 ASBESTOS CONTAINING MATERIALS AND ASBESTOS REMOVAL:

- A. No materials or material coatings containing asbestos shall be allowed on this project.
- B. All asbestos removal shall be by Owner. Asbestos is to be removed before the work is started. If the Contractor discovers asbestos which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.23 SYSTEM IDENTIFICATION:

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Below Grade Piping: Bury a continuous, pre-printed, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.
- C. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-4) and identifies the area or space served by the equipment. Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the exterior of the unit.

1.24 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.
- B. At the end of each work day, the Contractor shall cover all open ends of piping and ductwork with protective plastic.

1.25 ACCEPTANCE TESTING:

- A. All acceptance testing as required by California Code of Regulations, Title 24, and as noted on the Certificate of Compliance form, (where applicable), shall be performed and documented by an Acceptance Test Technician (ATT). These documents must be provided to the building inspector during construction and must be completed through an Acceptance Test Technician Certification Provider (ATTCP). The Contractor shall submit a copy of the documentation to the Engineer for review (hardcopy or electronic), prior to submitting to Administrative Authority.

1.26 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-3). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be

labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.

- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system. The Engineer's office shall be notified 48 hours prior to this meeting.

1.27 RECORD DRAWINGS:

- A. The Contractor shall obtain one set of blue line prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, walks. In addition, the water, gas, sewer, underfloor duct, etc. within the building shall be recorded by offset distances from building walls. As part of the Contractor's overhead expense, request a full set of reproducible drawings to transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review.

PART 2: - PRODUCTS (not used)

PART 3: - EXECUTION (not used)

END OF SECTION

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1: - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions, Section 23 00 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
  - 1. Air distribution system.
  - 2. All equipment as shown or noted on the drawings or as specified. Furnish motor starters except where motor control centers are used. Coordinate with Division 26.
  - 3. Circulating water system.
  - 4. Refrigeration system.
  - 5. System energy balance.
  - 6. Coordinate with Section 23 09 23 (Direct Digital Control and Energy Management System) regarding location and installation of system sensors and to provide simultaneous start-up.
  - 7. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, ductwork, braces, supports, housekeeping pads, temperature controls and related items no longer required.
- B. Work Specified Elsewhere:
  - 1. Line voltage power wiring, motor starters in motor control centers, disconnect switches and installation of all starters are included in the Electrical Section, unless otherwise noted.
  - 2. Connection of gas, condensate drains and domestic water to equipment.
  - 3. Concrete and reinforcing steel unless specifically called for in the drawings or specifications.
  - 4. Painting unless specifically called for in the drawings or specifications.
  - 5. Carpentry.
  - 6. Direct Digital Control and Energy Management System (DDC/EMS).

PART 2: - PRODUCTS

2.1 PIPING MATERIALS:

- A. Refrigerant Piping: Hard drawn Type ACR copper, dried and capped, ASTM B280. Wrought copper fittings, silver alloy brazed, 1100°F, Silfos.
- B. Miscellaneous Piping Items:
  - 1. Pipe Support:

- a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendations. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Anvil, Unistrut.
  - b. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Anvil, Unistrut.
2. Flashing: Flashing for piping through roof shall be prefabricated galvanized steel roof jacks with 16" square flange around pipe. Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials. For cold process built-up roof, material shall be 4 lb/ft<sup>2</sup> lead instead of galvanized steel. For single-ply roofing, use the roofing manufacturer's recommended flashing material.

## 2.2 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.
- C. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe. 0.024" thickness for fittings. Integral moisture barrier. Stucco-Embossed finish. Provide pre-fabricated aluminum strapping and seals by same manufacturer. ITW or RPR.
- D. Metal Jacketing Sealant: Childers CP-76, Foster 95-44.
- E. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft<sup>2</sup>-°F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.
- F. Foamed Plastic: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.27 Btu-in/hr-ft<sup>2</sup>-°F at a mean temperature of 70°F. 1/2" thick. Provide adhesive by same manufacturer. Armacell Armaflex.

## 2.3 DUCTWORK MATERIALS:

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50. Shall comply with 2022 CMC.
- B. Metal Ductwork: Metal ductwork shall be galvanized sheet steel, lock forming quality, ASTM A-653, with gage and construction to match SMACNA Standard for pressure required (26 gage minimum).

- C. Flexible Ductwork: Insulated flexible ductwork. One pound per cubic foot glass fiber insulation, 1-1/2" thick (R-6), 2" thick (R-8) where ductwork is outside the building thermal insulation envelope. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft<sup>2</sup>-°F at a mean temperature of 75°F. Seamless metalized reinforced polyester vapor barrier jacket. Continuous internal liner bonded to galvanized steel wire helix. Duct shall be capable of continuous operation at 1-1/2" of positive water static pressure and 4,000 ft/min air velocity. Duct shall be capable of continuous operation at 1-1/2" of positive water static pressure and 4,000 ft/min air velocity. Steel connection collars. Duct shall comply with NFPA 90A. JP Lamborn.
- D. Duct Sealants: All Joints Exposed to Weather: Sealant shall be G.E. "Silglaze II" or Silimax Multipurpose Silicone Sealant, without substitution. Joints Not Exposed to Weather: Fiber reinforced. White in color. Design Polymerics DP1030, Hardcast Versa-Grip 181, Hardcast CCWI-181. Joints Not Exposed to Weather and Exposed to View in Finished Areas: Non fibrated. Gray in color. Foster 32-19, Childers CP-146, Design Polymerics DP 1010, or United Duct Sealer WB.

#### 2.4 AIR TERMINALS AND DUCT FITTINGS:

- A. Grilles: (Grilles, Registers, Diffusers and Louvers)
  - 1. Information on Drawings: Refer to Grille Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description Titus. Equivalent models of Anemostat or Krueger are acceptable. Refer to the floor plans for neck size, CFM, air diffusion pattern and fire damper, if required.
  - 2. Performance: Submit complete performance data (throw, pressure drop, noise level, etc.) for all grilles proposed, other than those scheduled. Testing shall be in accordance with ANSI/ASHRAE 70-1991. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, pressure drop, throw and noise level.
  - 3. Frame and Accessories: All supply, return, and exhaust grilles shall not have an opposed blade volume control damper unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawings. Key or screwdriver operated, no slide bars.
  - 4. Finish: All ceiling and wall grilles and all louvers shall have a paintable white finish unless otherwise noted. Interior components (everything behind the face plate) shall be flat black. Floor grilles shall have an anodized aluminum finish unless otherwise noted.
- B. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated,



slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

- C. Extractor: Curved blade turns in adjustable position rigid frame. Tuttle and Bailey Deflectrol.
- D. Turning Vanes: Double wall, hollow metal, air foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne HEP.
- E. Flexible Connection: UL listed neoprene coated 30 ounce fiberglass cloth. 3" metal, 3" fabric, 3" metal. Ventglas.

## 2.5 DUCTWORK INSULATION MATERIALS:

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Fiberglass Blanket: **Installed** thermal resistance at a mean temperature of 75°F shall not exceed indicated value. 3/4 lb/ft<sup>3</sup> or 1 lb/ft<sup>3</sup>, **R-6** where ductwork is within the building thermal insulation envelope. 3/4 lb/ft<sup>3</sup> **R-8** where ductwork is outside the building thermal insulation envelope and/or above the roof. Faced with glass reinforced foil laminated to Kraft paper. Certainteed, Knauf, Johns-Manville, Owens-Corning.
- C. Acoustic Lining: Glass fiber. **Installed** thermal resistance at a mean temperature of 75°F shall meet or exceed indicated value. One side coated to prevent fiber erosion up to 6000 ft/min. Average noise reduction coefficient of 0.80. 1.5 lb/ft<sup>3</sup> density. 1" thick (**R-4.2**) where ductwork is within the building thermal insulation envelope. 2" thick (**R-8**) where ductwork is outside the building thermal insulation envelope and/or above the roof. Certainteed, Knauf, Johns-Manville, Owens-Corning.
- D. Bonding Adhesive: Design Polymerics DP2501, Foster 85-60.

## 2.6 EQUIPMENT:

- A. General Requirements:
  - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
  - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
  - 3. Ratings - Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
  - 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment

requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

5. Electrical:
  - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
  - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
  - c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
  - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
  - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
  - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
6. Fan Selection - Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:

- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance is completed and prior to acceptance.
- b. Filter Media: 2" media. MERV-13. Clean filter resistance 0.41" water at 500 fpm. Throw-away frame. Class 2. Camfil AP-Thirteen.
- 8. Screens: All duct or louver openings to the outside shall be covered with 1/2", 16-gage, galvanized wire mesh screen.
- 9. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
- 10. Sound Ratings: Shall be in accordance with ASHRAE 36 - 72. Sound ratings shall not exceed scheduled values.
- 11. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

**B. Packaged Heat Pump:**

- 1. General: Self-contained heat pump designed for outdoor installation. Factory assembled and tested. Refer to Paragraph 2.6A for general requirements. Provide all starters and relays required for operation. 24-volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Indoor air section fully insulated. Outside air inlet. Drain pan. Multivane centrifugal supply fan. ARI certified. Carrier.
- 2. Refrigeration: Sealed hermetic compressor with internal vibration isolating mount. Crankcase heater, high/low pressure switch, recycling timer. Suction line accumulator. Air cooled condenser with propeller fan. Nonferrous finned coil. Low ambient control to 35 degrees. 5-year extended warranty on compressor(s).
- 3. Controls: Compressor and fan motors shall have both thermal and current sensitive overload devices. Automatic defrost control (only if required) every 90 minutes for a period of not more than 10 minutes.
- 4. Accessories: Electric resistance heater, nichrome elements, over temperature and overcurrent protection. Emergency heat control to allow heater operation if compressor is inoperative.

**C. Split System Heat Pump:**

- 1. General: Refer to Paragraph 2.6A for General Requirements. Completely assembled and factory tested. Provide all starters and relays required for operation. All components by same manufacturer. Trane-Mitsubishi.
- 2. Outdoor Unit:
  - a. Compressor: Sealed hermetic rotary compressor with vibration isolator mountings. Crankcase heater, suction line accumulator, recycling timer.

High and low head pressure/temperature protection. Motor overload protection, low ambient feature to 20F cooling mode. High and low side service valves. Recycling timer. Single phase start assist kit. 5-year extended warranty.

- b. Fan and Coil: Finned tube non-ferrous coil. Propeller type fan, 1200 RPM maximum, direct drive. Totally enclosed motor, overload protected, permanently lubricated, resiliently mounted.
- c. Cabinet: Weatherproof, factory paint.
- 3. Indoor Unit:
  - a. Supply Fan: Direct drive, multi-speed forward curve, centrifugal fan, resiliently mounted. Thermally protected motor.
  - b. Indoor Coil: Copper tube, aluminum fin, DX coil.
  - c. Electric Heaters: Integral part of unit, complete with all operational and safety controls, single point wiring terminal, 5-year factory warranty, UL listed as a complete unit.
  - d. Condensate Pan: Install under complete coil area with drain connections.
  - e. Filter: Washable media. Class 2 or better.
- 4. Controls: Microprocessor control containing temperature selection, room temperature indication, automatic cooling/heating changeover, malfunction alarm, power failure automatic restart safety, and emergency operation function.

D. Exhaust Fan:

- 1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to weather shall have ventilated weatherproof housing over motor and drive assembly. Refer to Paragraph 2.6A for general requirements. All direct drive fans shall be provided with unit mounted speed controllers. All exhaust fans shall have a disconnect switch. All motors 1 horsepower and larger shall be the premium efficiency type.
- 2. Roof Fan (Direct): Spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners and stainless-steel fasteners on cap. Spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. Aluminum base shall have continuously welded curb cap corners for maximum leak protection. Discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency. Motor shall be heavy duty type with permanently lubricated sealed bearings and furnished at the specified voltage, phase and enclosure. Backdraft damper. Greenheck.
- 3. In-line Fan (Direct): Duct mounted, direct driven, centrifugal square inline. Fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. All

steel fan components shall be coated with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000-hour salt spray under ASTM B117 test method. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. Backdraft damper. Greenheck.

### PART 3: - EXECUTION

#### 3.1 PIPING INSTALLATION:

##### A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Pipe sizes shall not decrease in direction of flow, unless otherwise noted.
2. Joints:
  - a. Threaded: Pipe shall be cut square, and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
  - b. Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100°F. Brazing shall be performed by a Certified Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
  - c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
3. Fittings and Valves:
  - a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
  - b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
4. Pipe Support:

- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below (based on straight lengths of pipe with couplings only). Provide additional supports for equipment, valves or other fittings. Seismic requirements may reduce maximum spacing. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction.
  - b. Refrigerant Piping: Support insulated refrigerant line with construction channel and sheet metal support saddle or Cooper B-Line Armafix clamps. 5' spacing. Use isolation shield for uninsulated pipe. When using pre-charged tubing, all changes of direction shall be made with bending tools producing neat uniform bends. Free hand bends will not be accepted.
  - c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
5. Miscellaneous:
- a. Escutcheons: Provide chrome plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
  - b. Pipe Sleeves: All piping passing through concrete or concrete block shall be provided with pipe sleeves. Allow 1" (nominal) clearance between sleeve and pipe or pipe insulation.
  - c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.

- B. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing. Continuously purge with Nitrogen during brazing. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70°F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4" (min.) PVC conduit with long radius elbows. Seal ends of conduit watertight.

### 3.2 PIPING INSULATION INSTALLATION:

- A. Refrigerant Piping: Cover piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendations. Cover all fittings, unions, valves and connections. Piping exposed to view shall be covered with PVC jacketing. Piping exposed to weather shall be covered with aluminum jacketing, install all joints and seams to prevent water entry, seal with 1/8" bead of gray metal jacketing sealant.

### 3.3 DUCTWORK INSTALLATION:

- A. General:
1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA Standards. Ductwork shall be built to a pressure classification equal to or greater than the maximum operating pressure at that point in the ductwork. A copy of these standards shall be maintained at the job site at all times. Duct work and accessories shall be installed in a manner to prevent vibration and rattling.
  2. Access: Provide duct access doors as required to adjust equipment and dampers. Provide wall or ceiling access panels, or remote actuators as required where equipment and dampers are not otherwise accessible. Remote regulator shall be as detailed on drawings.
  3. Flanges and Escutcheon: Where ductwork penetrates walls, ceilings, or floors, furnish and install flange or escutcheon of same material as duct.
  4. Flexible Connections: Connection of ductwork to any vibrating equipment shall be with 3" (min.) flexible connection. Install with ample slack and uniform gap. There shall be no metal to metal contact across flexible connection. Flexible connections exposed to weather shall have a protective sheet metal cover.
- B. Low Velocity-Low Pressure (up to 2,000 ft/min and up to 2.0 in water):
1. Sheet Metal Ductwork:
    - a. Ells: Ells with less than standard radius and square ell shall be fitted with turning vanes.
    - b. Tees: Tees in supply ductwork shall be straight tap-in with extractor or 45 degree take-off as shown on drawings. Grilles or branches in supply ductwork shall be a minimum of 8 duct diameters downstream of tees.
    - c. Duct Joints and Seams: All joints and seams which are not exposed to weather shall be sealed airtight with duct sealant. All joints and seams exposed to weather shall be sealed air and water tight with outdoor sealant. (See Part 2 of this Specification). All joints on metal ductwork exposed to view inside building shall be sealed air tight with grey duct sealant.
    - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
  2. Flexible Glass Fiber Ductwork: The use of flexible duct is limited to the last 5 feet of each branch duct (i.e. one 5 foot section of flexible duct may be used to connect the grille to the sheet metal branch duct). No joints are permitted in this 5' length. Hangers shall be 4" wide metal straps spaced to prevent sagging, 42" spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. Joints shall be installed with stainless steel or nylon draw bands, Duro Dyne Dyn-O-Tie. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius of duct centerline not less than 1.5 times the duct diameter).

### 3.4 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA Standards. Terminals and fittings shall be installed in a manner to prevent vibration and rattling. Metal surfaces exposed to view behind grilles and registers shall be painted flat black.

3.5 DUCTWORK INSULATION INSTALLATION:

- A. General: Insulate all sheet metal supply, return and outside air intake ductwork except as noted below. Insulation shall be continuous through walls and floors except at fire dampers.
- B. Where Insulation Is Not Required: Do not insulate factory-insulated ducts or casings, acoustic lined ducts, fibrous glass ducts, underground ductwork, supply or return ductwork exposed to view in the space that it serves, or exhaust ductwork.
- C. Concealed Ductwork: Wrap concealed ductwork including outside air intakes with fiberglass blanket lapped 2" minimum. Secure with staples 4" on centers maximum on straight runs and 3" maximum at elbows and fittings. Insulation on bottom of ducts wider than 36" shall also be secured with mechanical fasteners at 24" on center.
- D. Acoustic Lining: Unless otherwise indicated, all supply and return ductwork in equipment rooms, all ductwork exposed to weather and other ducts as indicated on drawings, shall have acoustic lining. Do not acoustic line outside air intakes. Where acoustic lining is installed, increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.6 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to ensure that no work done under other specification sections shall in any way block or otherwise hinder the equipment. All equipment shall be securely anchored in place. All equipment shall be installed level.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.
- C. Equipment Platforms: Shall be as shown on drawings and as follows: Flashing and platform cover shall be 22 gage (min.) sheet metal. All joints and seams shall be soldered with 2" (min.) overlaps. Provide 3/4" gap around perimeter between roofing and platform cover to facilitate re-roofing. Extend drip lip down 3" (min.). Provide 30# felt under platform cover.

3.7 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested.

3.8 SYSTEM ENERGY BALANCE:



- A. Scope: Provide the services of an independent test and balance agency to test, adjust and balance, retest and record performance of the system to obtain design quantities as specified. The agency must prove that they have no affiliation with any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report.
- B. Qualifications: Prior to commencing work, the agency shall be reviewed by the Engineer and shall be certified by the Associated Air Balance Council, National Environmental Balancing Bureau or Testing, Adjusting and Balancing Bureau. The agency shall provide documentation of having successfully completed at least five projects of similar size and scope.
- C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC, NEBB or TABB standards.
- D. Submittals: Include in shop drawings copies of forms to be used for testing and balancing showing all data which is to be recorded. Three copies of completed balance report shall be submitted to and reviewed by the Mechanical Engineer prior to the final mechanical construction review.
- E. Procedure - General: Procedure shall be in accordance with Associated Air Balance Council's "National Standards for Field Measurements and Instrumentation - Total System Balance", Volume Two, No. 12173, or equivalent NEBB or TABB standards. System shall be in full, continuous operation during test. Balanced quantities shall be plus 10%, minus 0% of design quantities. All nameplate data, manufacturer, model and serial numbers shall be recorded for each item tested.
- F. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Engineer, at his discretion, may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.
- G. Air Balance Procedure (For Each Air Handling System):
  - 1. All air filters shall be clean when air balance is performed.
  - 2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
  - 3. Adjust blower RPM to design requirements.
  - 4. Record motor full load amperes.
  - 5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
  - 6. Record system static pressures, inlet and discharge.
  - 7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
  - 8. Adjust system for design CFM recirculated air.
  - 9. Adjust system for design CFM outside air.
  - 10. Record entering air temperatures. (DB heating, DB and WB cooling.)

11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
12. Adjust all main supply and return air ducts to design CFM.
13. Adjust all zones to design CFM, supply and return.
14. Adjust all diffusers, grilles and registers to plus 10%, minus 0% of design requirements.
15. Adjust CFM at all exhaust fans, make up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
16. Each grille, diffuser and register shall be identified as to location.
17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees upward deflection unless otherwise noted. Make a notation of any that are not set properly.
18. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.
23. Set, test and adjust packaged heating/cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.
24. Verify that the Controls Contractor has commissioned and documented their work before the TAB work begins.

END OF SECTION



SECTION 23 09 23 - DIRECT DIGITAL CONTROL AND ENERGY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

- A. The General Mechanical Provisions of Section 23 00 00 shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. General: The direct digital control and energy management system (DDC/EMS) includes control panels, control devices, valves, actuators, all line and low voltage control and interlock wiring (including wiring to controllers, switches, timers, relays, etc.) and conduit and related equipment, as required for proper operation of all equipment. Provide all equipment, programming, labor, materials and services necessary for a complete, lawful and operating DDC/EMS as shown or noted on the drawings and as specified herein. All control wiring, line and low voltage shall be installed in conduit. Power wiring, power to DDC/EMS control panels and disconnect switches are included in the Electrical Specifications, except that power wiring for control devices such as controllers, valves, etc., is included in the control system. Electrical work shall be in accordance with Electrical Specifications. **The control system shall be direct digital control/electric. Honeywell WEBS or Vykron Supervisory Controller to match existing, no exceptions on Building Control. The system shall be Niagara 4, HTML5 based, with open license supervisory controller. All field controller hardware "Building Control" shall be Honeywell Independent Licensed Controllers. All Plant Controller hardware shall be Honeywell CIPer Controllers.** The system shall communicate over the District's Ethernet LAN/WAN, and shall include the latest upgrading (software and firmware) during the warranty period. The data wiring shall have an Ethernet connection at the DDC/EMS panel. A Graphical User Interface (GUI) shall be provided. Coordinate with Section 23 00 01, Heating, Ventilating and Air Conditioning and with Division 26. Comply with ASHRAE 55 and Title 24.
  - 1. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work.
  - 2. Provide access to hardware and software or onsite technical support required to assist the TAB effort. The hardware and software or the onsite technical support shall be provided at no cost to the TAB Firm.
- B. Contractor Qualifications: All controls shall be furnished and installed by a Contractor who is licensed, N4 certified and approved by the controls manufacturer for design, installation, start-up and service of their product. The Contractor must have sufficient personnel to respond to a trouble call at the site within four hours. The Contractor's local manager shall have a minimum of five years' experience in the design, installation, start-up and service of similar systems. The Contractor shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number and controls contract value.

- C. Submittals: Within 30 days of contract award, submit shop drawings showing the following aspects of the DDC/EMS system (CAD file with DXF format if required of floor and site plans can be secured from the Architect).
1. All termination points, terminal cabinets, and cabling.
  2. Schedule of input and output points.
  3. Locations of all visible DDC/EMS system components (i.e. interior and exterior sensors, terminal strips, panels, trench and pull boxes, etc.), identifying specifically any exposed conduit.
  4. Descriptive literature for all material and equipment items shall include manufacturer's name and catalog numbers, dimensions, capacities, and all other characteristics and accessories as listed in the specifications or on the drawings.
  5. Submit copies of forms to be used for testing and verification showing all data which is to be recorded. Three copies of complete report shall be submitted for review.
  6. Complete written sequence of operation for all controlled equipment.
  7. 60 day submittal for graphics package. PDF.
- D. Installation and Operation Manuals: Furnish Installation and Operating Manuals for all components. These manuals shall contain full documentation which shall include, without being limited to, the following:
1. General description and specifications.
  2. Installation and initial checkout procedures.
  3. Complete alignment and calibration procedures for all components.
  4. Detailed schematics and assembly drawings and communication trunk diagram with control unit addresses.
  5. BACNet architecture diagrams
  6. Sequence of Operations.
  7. Controller points lists.

### 1.3 SYSTEM ARCHITECTURE

- A. DDC/EMS Equipment: The main controller shall contain the network communications and information management programs providing integrated global control, trend logging, local and remote alarming and fully menu driven user interface. The local network controller must be an intelligent, stand-alone microprocessor based controller which can have a variety of configurations based on their application.
- B. Campus-Wide Data Transfer System: The DDC/EMS shop drawings shall indicate where all equipment items are to be located for input and output to complete the system. The conduit/cabling system shall inter-tie these points as required to complete one system to meet the design criteria herein. Conduit shall be used for all EMS wiring whenever access is limited (hard-lid, walls, etc) or exposed on the interior or exterior. Rigid Conduit shall be used for all mechanical, electrical, equipment rooms. EMT shall be used for all above inaccessible areas. When EMS wiring is installed in/above accessible areas (such as T-bar ceilings), free-air with J-hooks and velcro wire-ties is acceptable. However, EMS wiring cannot be intermixed or bundled with any other cabling/wiring (Fire Alarm, internet, etc). BACnet MS/TP and BACnet IP cable shall be per BACnet wiring specifications.

- C. User Interface Communication: The user may communicate with the DDC/EMS system with a workstation located at the District Office over the WAN, with a remote workstation, with an On-Campus Operator Workstation, or with a Lap-Top computer (Service Tool).
- D. Standard Network Support: All Master Controllers, Workstation(s) and File Server shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN. Furthermore, the Master Controllers, Workstation(s) and File Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers and switches. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Technology Department as all devices utilize standard TCP/IP components. If the DDC/EMS contractor needs an additional data port that is not already provided, its installation must be coordinated with the District's IT department (and IT infrastructure contractor if applicable) and shall be installed at the DDC/EMS contractor's expense. As a result, the DDC/EMS contractor shall ensure any additional data port locations are clearly indicated and that the existing EMS data ports they intend to utilize are addressed/identified prior to construction so they are not damaged or removed. This coordination shall occur between the District's Construction Office, IT department, DDC/EMS operator, IT infrastructure contractor (if applicable), and the project's general construction contractor manager.

## PART 2 - PRODUCTS

### 2.1 GENERAL:

- A. General Requirements: The Electronic Microprocessor Based Direct Digital Control and Energy Management System (DDC/EMS) shall monitor the data environment and perform control functions in relation to a programmed strategy and the status of the data environment. The system shall use solid state computer based digital and analog technology. The system shall be standard with the manufacturer to insure on going parts availability and trained technical support. The DDC/EMS shall be of the user programmable type requiring no special computer education for operation. All necessary instruction manuals and user orientation training shall be supplied by the manufacturer or agent thereof. The DDC/EMS shall be UL listed as a Direct Digital Control and Energy Management System. The programmable control requirements of the DDC/EMS shall include, but not be limited to:

OPTIMUM START/STOP (BASED ON HISTORICAL DATA)  
TIME OF DAY ROUTINES  
SCHEDULED OCCUPANCY ROUTINES INCLUDING HOLIDAYS  
CUSTOM TAILORED REPORTING  
ACCUMULATING RUN TIME  
CRITICAL CONDITION ALARMING  
FLUID FLOW SWITCH AND CONTROL ALARMING  
PID CONTROL ON ANALOG OUTPUTS  
HOT WATER RESET

DAY/NIGHT SETBACK  
ECONOMIZER/PURGE  
CUSTOM TAILORED REPORTING  
ACCUMULATING RUN TIME  
POINT OVERRIDE ABILITY FOR EVERY DIGITAL AND ANALOG OUTPUT  
SEPARATE MODES AS REQUIRED BY CONTROL SEQUENCE  
ALL EXTERIOR LIGHTING CIRCUITS CONTROLLED BY SYSTEM

- B. Environment: The DDC/EMS shall operate in an environment of 40 120 degrees F and 10 95% relative humidity. Sensors and control elements shall operate under the temperature, pressure, humidity, and vibration conditions normally encountered in the installed location. The DDC/EMS shall maintain accuracy as follows:
1. +/- 0.5 F for the space temperatures in the 0 F 130 F range.
  2. +/- 0.5 F for duct temperatures in the 40 F 130 F range.
  3. +/- 1.0 F for outside air temperatures in the 30 230 F range.
  4. +/- 1.0 F for water temperature in the 30 230 F range.
  5. KWH and KW monitoring within 1.0%.
- C. Battery Backup: The system shall be tolerant of power failure and hold memory for a minimum of 12 hours. On power restoration, the system shall automatically and without operator intervention of execution of manual restart procedures:
1. Come On Line.
  2. Update all monitored functions.
  3. Resume operation based on current time and status.
  4. Implement special building start up strategies as required.
  5. Log time of power outages and start ups.
- D. Fail-Safe Operation: JACE shall operate stand-alone in any event of network communications loss. This implies to all their respective components for example, Chiller Plants, Boiler Plants, Pumps, AHUs, VAVs, Fan-coils, Heat Pumps, Package Units, Makeup Air Units, Unit Ventilators, Exhaust Fans and Lighting.
- E. Program Storage: All JACE 8000 hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted "safe boot" technology.
- F. Protocol: Protocol shall be BACNet. The Main Controller shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default.
1. BACNet
  2. Lon
  3. Modbus
  4. SNMP
  5. ASD
- G. The Main Controller shall provide the following hardware features as a minimum:
1. Two 10/100 Mbps Ethernet ports.
  2. Two Isolated RS-485 ports with biasing switches.
  3. 1 GB RAM
  4. 4 GB Flash Total Storage / 2 GB User Storage
  5. Wi-Fi (Client or WAP)

6. USB Flash Drive
  7. High Speed Field Bus Expansion
  8. -20-60°C Ambient Operating Temperature
  9. Integrated 24 VAC/DC Global Power Supply
  10. MicroSD Memory Card Employing Encrypted Safe Boot Technology
- H. The Main Controller shall be provided with a 5 Year (SMA) Software Maintenance Agreement. Labor to implement not included after warranty period.

## 2.2 SYSTEMS DESCRIPTION:

- A. Modular Design/Expandability: The DDC/EMS shall be of a modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions. The modular DDC/EMS shall be configured on the main/local concept. The main controller shall have the capability of adding local controllers and the local controllers shall be capable of adding I/O modules.
- B. Main (Master) Description: The master shall function as the overall system coordinator, accept control programs, perform automated energy management functions, control peripheral devices and perform all necessary mathematical calculations. The master shall be a microcomputer of modular design. The word size shall be 16 bits or larger, with a memory cycle time less than 1 microsecond. All chips shall be second sourced. The master shall have the following:
1. Protected Access: Key lock protected access to output override switches and internal circuitry.
  2. Memory: The master shall have memory required for systems operation and diagnostics or MCP software.
  3. Real Time Clock: The master shall have a battery backed uninterruptable "Real Time Clock". The accuracy shall be within ten seconds per day. The RTC shall provide the following information: Time of Day, Day, Month, Year, and Day of Week. The system shall be programmed to automatically correct the clock for day light savings time and leap years and Time Sync.
  4. Power: The master shall operate from 120 VAC +/- 20%, 60 Hz. Line voltages below the operating range of the system shall be considered outages. The master shall have over voltage surge protection, and require no additional AC power signal conditioning.
  5. Parallel Processing: The master shall be capable of parallel processing, executing separate control programs simultaneously. Any control program may affect control of another program if desired. Each program shall have full access to all I/O facilities of the processors.
  6. Communications Processor: Each master shall provide communication to the District's Workstation(s) (LAN) and the field buses. In addition, each master must have communications ports that support portable service tool and connection to third party controllers such as a chiller control panel or Variable Frequency Drives.
  7. Uninterruptable Functions: Control functions shall not be interrupted due to program entry or other user communications.



- C. Local Controller Units: The local units function as a stand-alone controller and as an Input/Output interface of the DDC/EMS and the Data Environment.
1. HVAC units must be fully controlled by a controller connected to the DDC/EMS that can be fully programmed by the DDC/EMS contractor.
  2. Monitoring: Local units shall be used to connect the data environment to the system and contain all necessary Input/Output functions to read field sensors and operate controlled equipment based on internal instructions or instructions from the Master. The units shall be fully supervised to detect failures. The units shall report the status of all points in its data environment at the rate of at least once every second. Local units shall connect directly to the Master with a twisted pair shielded RS-485 interface.
  3. Unit Failure: Upon failure of the unit (including transmission failure), the unit shall automatically fail off or to a predetermined state for three-way valves. All local units must run independently in the event of a central unit failure (including transmission failure) in bypass mode via the thermostat.
  4. Power: The unit shall operate from 120 VAC, +/-20%, 60 Hz, 220 VAC, +/-20%, 50 Hz or 24 VAC +/- 20%, 50/60 Hz power. For voltages below the operating threshold the unit shall totally shutdown and de energize its outputs.
  5. LAN and/or Field Bus: Each unit shall communicate with any unit through the RS-485 interface LAN and/or field bus.
  6. Auxiliary Port: Each unit shall be equipped with an auxiliary port to allow local interrogation of input and output values, and keyboard override of outputs through laptop.

### 2.3 INPUT/OUTPUT CAPABILITY:

- A. Inputs: The DDC/EMS shall accept information in the form of a temperature, voltage, digital signal (on off) or pulse counter.
1. Analog Inputs: The Analog Input (AI) function shall monitor each analog input, perform A/D conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be within the range of 0-10 VDC.
  2. Digital Inputs: The Digital Input (DI) function shall accept dry contact closures and voltage level or resistance level (5VDC reference voltage) transitions. A voltage level below 1 volt or a resistance below 500 ohms shall be read as ON (closed), a voltage level above 3 volts or a resistance above 1400 ohms shall be read as OFF (open).
  3. Pulse Accumulator Inputs: The pulse accumulator function shall have the same characteristics as the DI, except that, in addition, a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses at a minimum of 2 per second.
  4. Temperature Inputs: Temperature inputs originating from a thermistor, shall be monitored and buffered as an AI, except that, automatic conversion to degrees F shall occur without any additional signal conditioning.
  5. Input Wiring: All analog inputs shall be two wire devices, with shielded wire for accurate operation.
- B. Outputs:

1. Master and local controllers - Form C relay outputs rated at 5 amp, 24 VAC/DC or 2 amp, 30 VAC for on/off or Pulse Width Modulation for maintained operation of field devices. Output pulse width shall be selectable between 0.1 and 3200 seconds with a minimum resolution of 0.1 seconds. Isolation and protection against voltage surges shall be provided. Central plant controllers shall be equipped with an ON/OFF/AUTO switch to manually obtain either output state. Manual overrides shall be reported to the master at each update. An LED shall be provided to indicate the state of each digital output.
2. All digital and analog output points on every controller must have an override (highest priority) input point in the controller's point list in the JACE. This override point must be clearly labeled and identifiable. For example, "DO1ovrd" would be the point to override Digital Output 1.

#### 2.4 SOFTWARE:

- A. User Software: HTML5 based. Provide software (required upgrades) for Laptop Computer (Service Tool) and District office workstation, as required.
- B. Software Features:
  1. Mathematical Requirements: The DDC/EMS shall have a math package capable of addition, subtraction, multiplication, division, square root, greater than and less than functions, minimum and maximum selection functions, and up to five levels of parenthesis for computation of variables. Control commands may be executed based on these calculated variables which are available to the program on a global basis. Math expressions may be used in action and exit commands of control program. The mathematical software shall be capable of mixed mode arithmetic, utilizing Boolean logic statements in combination with basic arithmetic to provide conditional mathematical computations.
  2. Passwords: The DDC/EMS shall have multiple levels of user programmable passwords in addition to a master password, for programming security. Separate passwords may be user programmed. Level of password will define user's access level and ability to change system.
  3. Trend Logging: The DDC/EMS shall trend log variables. Any system variable (inputs, outputs, numerals, can be trend logged.
  4. Messages: The DDC/EMS shall provide alarming, preventative maintenance and status reporting messages.
  5. Documentation Format: The programming language of the DDC/EMS shall be plain English based such that a printout of the control program shall serve as the primary documentation for the system.
  6. Micro Processor Integrity Checking: Each DDC/EMS microprocessor shall continuously monitor and check itself and produce error messages in the event of a malfunction.
  7. Data Plotting: The DDC/EMS shall provide plots of values of system variables on a graph. Graphs may consist of combinations of up to 3 system variables at a time from the history logs.
- C. Color Graphics Requirements Provide Niagara PX or Envision HTML5 based color graphics which allow user to access, change and override (based on user access level) all schedules and setpoints (including damper or control valve signals) directly through the

user graphics. Real time data shall continuously be updated. Navigation between the screens (forward and backwards) shall be accomplished with the use of a mouse. The minimum graphic screens shall include the following:

1. Site lay-out locations of all equipment being controlled, control component locations, and spaces served. Provide multiple screens-minimum of 1 screen per building plus site and others as needed for clarity. By "clicking" mouse on the desired equipment area a flow diagram will be displayed for the related equipment (as described below - Item 2). By "clicking" the mouse on a conditioned space, a graphic display of the zone conditions (as described below - Item 3) will be displayed.
2. Each building must have a graphical summary page of all the zones in that building that displays zone temperature, set point, discharge air temperature, and fan command.
3. Zone & HVAC Equipment Description on GUI: Each item of HVAC equipment must be clearly identified by what area it serves and its unit number. For example, if HC-2A serves Classroom 4, the GUI should list it as "Classroom 4, HC-2A." It should NOT be listed as only "HC-2A" or "Classroom 4."
4. Flow diagrams shall be provided for each HVAC system, such as air-handling system, chilled water system, hot water system, condenser water system, package unit system, brine system with all inputs and outputs dynamically displayed.
5. Each temperature control zone shall have a screen providing set points, temperatures, and related HVAC system status data. Must have click option to pull historic data from the monitoring points.
6. Scheduling screens allowing On/Off times to be set.

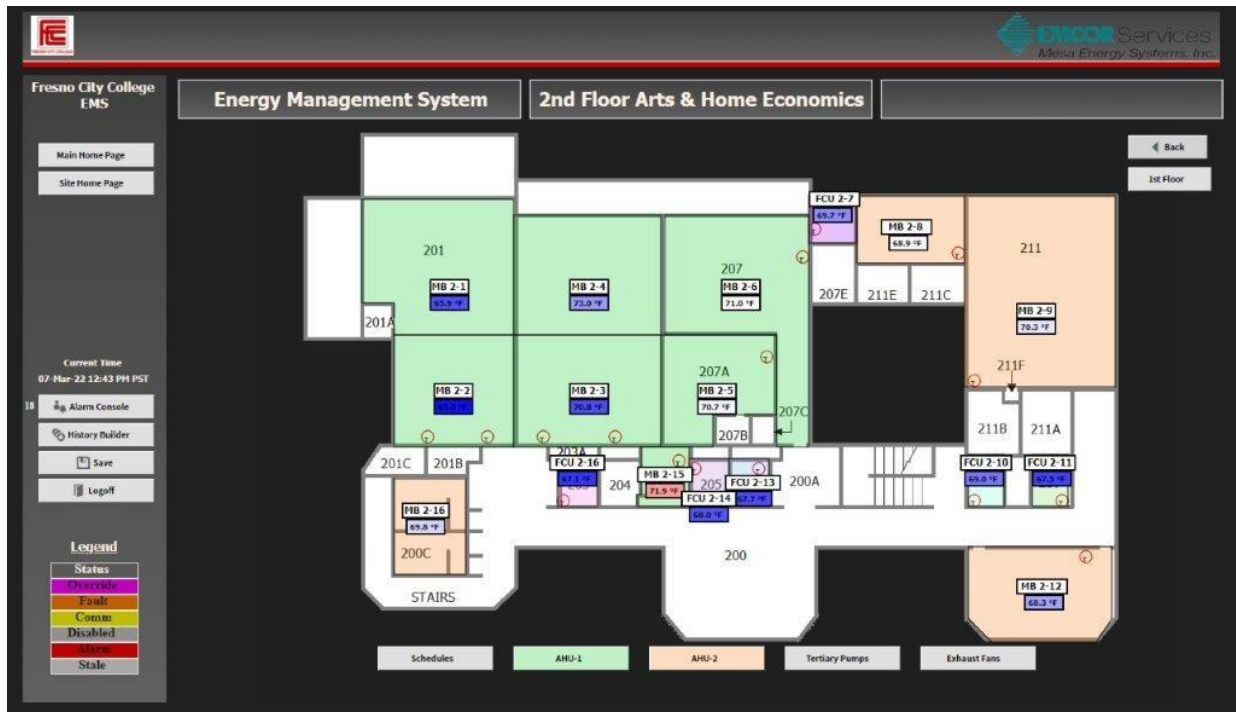
D. Graphic Standard:

1. Floor Plan: Areas must be color designated by equipment being served.
2. Zone Sensors: Must display temperature monitoring with name and or room number designations. Background image shall change color when out of set-point range.
3. HVAC Equipment: Must display all point monitoring information. Temperature, pressure, current, voltage, status, occupancy, set-points and modes.
4. Site Lighting Plan: Must display overview of all mapped lighting points and name designations that correspond with areas being served. Building Lights ON or OFF, Exterior Lights ON or OFF, etc. on a single graphical page located on the main page for the campus.
5. Animation: Fan, valve / damper actuators, coils, compressor, pump, lights must represent real time status.
6. Override Functionality: All controller outputs shall be able to be overridden from the GUI. All control logic setpoints shall be able to be adjusted and or overridden from GUI.

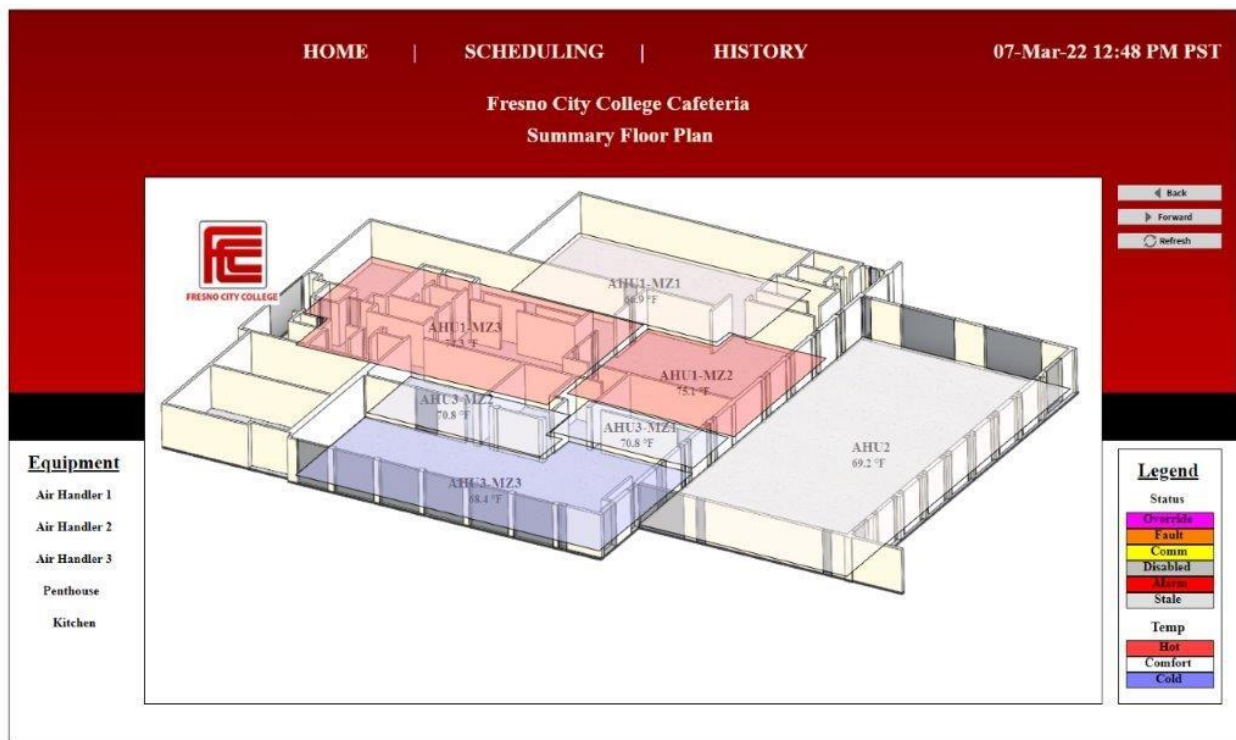
# DIRECT DIGITAL CONTROL AND ENERGY MANAGEMENT SYSTEM

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Example:



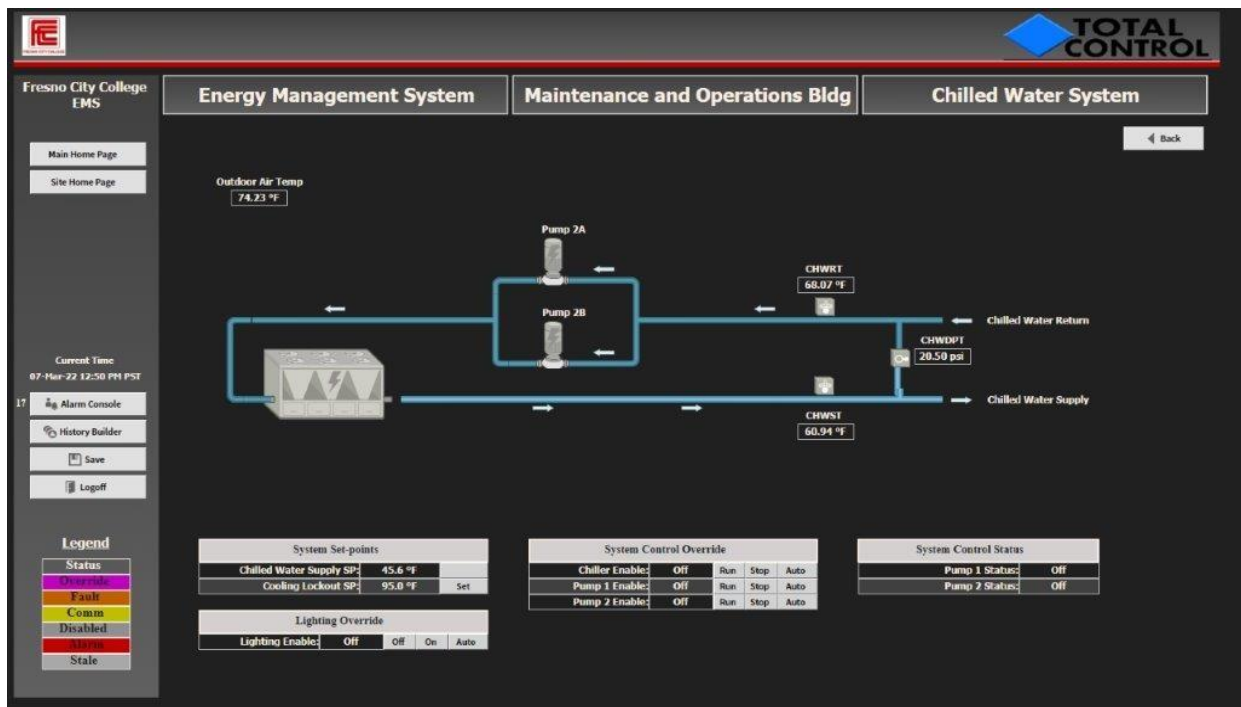
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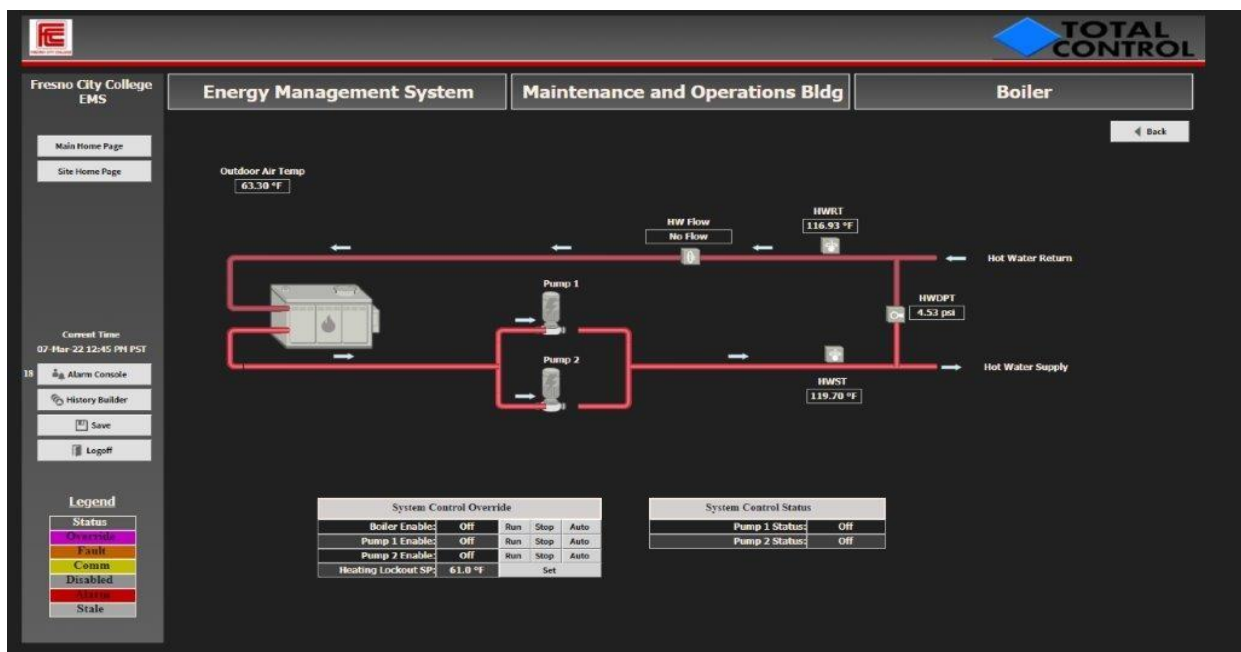
# DIRECT DIGITAL CONTROL AND ENERGY MANAGEMENT SYSTEM

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Example:



Example:



- E. Software Manual: The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software feature. The manual shall instruct the user on programming or reprogramming any portion of the system. This shall include all control programs, variables, set points, time periods, messages, passwords and other information necessary to load, alter, test and execute the system. The manual shall include commands, editing and writing control programs, printouts and logs, mathematical calculations, and instructions on modifying any control point, verifying error status, changing passwords, and initiating or disabling control programs.
- F. Software Licenses: The owner shall be named the license holder of all software associated with any and all incremental work on the project(s). All Niagara 4 software licenses shall have the “accept.station.in=\*”; “accept.station.out=\*”; “accept.wb.in=\*”; and “accept.we.out=\*” section of the software licenses. The intent is to insure that the installed Niagara 4 products may be completely open for integrations. Owner shall be free to direct the modification of the software license, regardless of supplier. In addition, the Owner shall receive ownership of all job-specific software configuration documentation, data files, and application-level software developed for this project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use within Niagara Framework (Niagara 4) based controllers and/or servers and any related LAN/WAN/Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner. Admin account shall be specifically allocated to the Owner and the password shall be changed during the training process.

## 2.5 USER INTERFACE:

- A. LAN Connections: Additional LAN connections shall be installed per the District’s IT Network requirements and coordinated with the District’s networking staff prior to installation. The planned location of all LAN connections (new and existing) to EMS equipment must be coordinated with the District’s networking staff and EMS staff as early as possible. This work is done by District's IT infrastructure Contractor. Final connections shall be made by DDC/EMS Contractor.
- B. Direct Computer Communication: The DDC/EMS shall have a computer compatible communication mode for communication with other intelligent devices, which performs data integrity checking, with automatic retransmission of data when errors are detected.
- C. JACE software must include all applications to make all folders viewable and accessible in the JACE.

## 2.6 SYSTEM COMPONENTS:

- A. Control Components:
  - 1. Wall Switches: Plates for all wall switches and timers shall match those specified in Division 26.
  - 2. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high engraved lettering, minimum.

3. Temperature Sensors:
  - a. Sensor Type: All temperature sensors shall be made of a highly stable, precision thermistor material accurate to within  $\pm 0.36$  Degrees F. Identify each temperature sensor with a "Lamicoid" label keyed to the control system as-built drawings.
  - b. Room Sensor: Room temperature sensor shall have Executive Decorator housing with programmable visible temperature indication. Housing shall include an occupancy override, temperature setpoint adjustment and a service tool jack.
  - c. Vandal Resistant Room Sensor: Where noted, shall be a blank stainless steel wall plate with the sensing element bonded to the back side. The plate back shall be insulated to reduce wall temperature influence.
  - d. Duct Sensor: Duct temperature sensor shall be a probe type element with 9 inch insertion length. Element shall be installed where air mixture provides a true temperature indication. Where adequate mixing is not practical, the duct temperature sensor shall have an averaging type thermistor element, installed across the entire cross section of the duct.
  - e. Outdoor Air Sensor: Outdoor air temperature sensor shall be a probe type element mounted in a ventilated, treated white PVC sun shield to minimize radiant energy effects. The sensor and sun shield shall be mounted on a weatherproof outlet box for outdoor installation.
  - f. Low Differential Air Pressure Applications (0" to 5" W.C.): The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points. Non-interactive zero and span adjustments, adjustable from the outside cover. (0.00 - 1.00" to 5.00") W.C. input differential pressure ranges. 4-20 mA output. Maintain accuracy up to 20 to 1 ratio turndown. Reference Accuracy:  $\pm 0.2\%$  of full span.
  - g. CO2 Sensor: The sensor shall have a five year recommended calibration interval. In addition, the sensor shall be provided with a five-year calibration guarantee, providing for free factory replacement if the sensor is found to be out of calibration within five years of the purchase date. The sensor shall have accuracy of  $\pm 50$  ppm and repeatability of  $\pm 20$  ppm. All adjustments to the sensor including output scaling, elevation adjustment, relay set point, relay dead-band, linear or exponential output, and single point calibration shall be made via on-board push buttons and LCD display. The LCD display must be covered by a solid door and only viewable when the door is opened for adjustments.
4. Temperature Control Panels: Each panel and each control device or readout on the front of the panel shall be identified with a laminated plastic label with 1/4" high engraved lettering, white on black background. Pilot lights shall be the push to test type.
5. Smoke Detectors: Furnished and installed by Division 26. Power and fire alarm wiring by Division 28. Control wiring by Division 23. Coordinate with Division 26.
6. Status Sensor: Current sensing status sensor (with sensitivity adjustment for belt loss detection).
7. Electric Actuators:

- a. General: Fully modulating, UL listed. Visual position indicator, manual override and clear weather shield where exposed to weather. 24 volt. Belimo or Honeywell.
  - b. Valve Actuators: Provide with factory mounting brackets and linkage to the control valve. Capable of shutting off against a 50 psi differential.
  - c. Damper Actuators: Positive position feedback and spring return. OSA dampers shall be spring return closed. Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 in-lbs torque per square foot of damper face area.
- B. Lighting Control Panel: The DOC/EMS Contractor shall coordinate with Electrical Contractor regarding integration of new or existing systems. This system shall have BACnet/IP or MS/TP protocol interface. All lighting points must be mapped with name designations that correspond with areas being served on GUI. attach separate lighting schedules to designated areas and a master override schedule for testing of all lighting circuits.
- C. Conduit: Conduit to be a minimum 3/4" diameter, and to have at least 25% spare capacity, except drops to room sensors may be run in 1/2" conduit. Conduit shall be run in electrical or mechanical trenches wherever possible. Site conduit (building to building) will be installed (and terminated inside the building) by Division 26. Conduit shall be run in all outdoor exposed areas and indoor areas exposed to view (i.e. no ceilings).
- D. Communication Cabling:
- 1. TIA-485 Electrical Standard
  - 2. Color: Blue
  - 3. Type: Shielded Twisted Pair Copper wire, tinned.
  - 4. Impedance: 120 Ohm
  - 5. Capacitance (wire to shield): <25 picofarads per foot
  - 6. Capacitance (wire to wire): <13 picofarads per foot
  - 7. Plenum Rated, Underground Rated when underground.
  - 8. Maximum Length: 4000 feet (no biasing is 500 feet)

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION:

- A. General: All electrical work shall be in accordance with the California Electrical Code and the Electrical Specification Sections. All electric/electronic systems shall be hardwired in conduit, except as specifically allowed by 1.3, B. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise. Provide a 120 volt circuit to the TCP and PSP's. EMS contractor shall coordinate with electrical contractor on the location of each TCP and PSP. Dedicated circuits shall be provided where required. Coordinate with Division 26 for new circuits. Any devices or wiring exposed to



the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit.

- B. Labeling of System: DDC/EMS Contractor shall provide complete labeling of all terminals at all panels or equipment terminal strips and wiring. Equal to Brady marking on wires and number on terminals in sequence corresponding to control diagram.
- C. Programming:
1. The Direct Digital Control and Energy Management System (DDC/EMS) operational program shall be provided by the DDC/EMS Contractor. The DDC/EMS Contractor shall be responsible for programming the system and shall coordinate the scheduling (on/off times) with the Owner. Prior to start-up, the DDC/EMS Contractor shall provide any testing program he feels necessary to fully test the operation of the various components. The DDC/EMS Contractor shall provide a PVT "Performance Verification Test" per the sequence of operation developed by the mechanical engineer during the submittal phase. The owner shall approve the PVT's for each system before the EMS Contractor is to execute the PVT. The PVT's include written testing sequences and a result of the test. Each test shall be developed to encompass each portion of the sequence of operation. PVT's shall be performed in the presence of the owner representative. The owner can choose to waive the requirement for the PVT to be executed in the presence of the Owner Representative. The Owner shall review the PVT's. The warranty period shall not start until the PVT's have been approved by the Owner.
  2. The DDC/EMS Contractor shall load the operational program into the DDC/EMS controller from his office via the District's network (via VPN) or at the job site via a direct connect cable. Prior to starting up the system, the DDC/EMS Contractor shall:
    - a. Confirm that the control system has been connected to the District's LAN/WAN and that the LAN/Wan is working.
    - b. Confirm the functionality of the DDC/EMS controllers and all input points by reading the input values, and comparing them with a measured temperature, pressure, voltage, current, or resistance as appropriate. Calibrate all transducers as required.
    - c. Confirm the functionality of all digital output points by manual operational of the relay contacts. Use proper discretion in starting and stopping equipment.
    - d. Confirm the functionality of all analog output points by manually imposing an adjustable voltage on the appropriate circuit to check proper operation of the controlled device. Calibrate all transducers as required.
    - e. The DDC/EMS Contractor shall notify the General Contractor (one week in advance of) when the system will be ready for loading and testing the operational program. The DDC/EMS Contractor's start-up technician shall be present while the program is being loaded and shall communicate with the programmer prior and after program loading to confirm proper operation.
- D. Training: Prior to final acceptance, the DDC/EMS Contractor shall provide operational training to the Owner's personnel. The training sessions shall include a complete

demonstration of the system. Dates and times of the training sessions shall be coordinated through the Owner not less than one week prior to session. A total of 8 hours of instruction shall be provided. The DDC/EMS Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The DDC/EMS Contractor shall submit a copy of this log on request.

- E. Testing and Acceptance: The DDC/EMS Contractor shall furnish a complete and operating system. The DDC/EMS Contractor shall also verify, in the presence of the Owner, the system accuracy and proper function of each controlled device and sensor. The following items shall be successfully demonstrated prior to acceptance by the Owner:
1. All system shall be commissioned by Owner to prove complete functionality. This includes logic programming and override ability of binary outputs and analog outputs through GUI.
  2. All system outputs including controllers, relays, and other control devices shall be addressed and start/stop functions demonstrated.
  3. All inputs shall be displayed and all event-initiated functions shall be demonstrated.
  4. Demonstrate program integrity and power restore sequence during and after a power failure and restoration.
  5. Deliver all Record Drawings, wiring diagrams, equipment specifications, installation and Operation Manuals and other documentation as required to describe the system. SCP shall have completed laminated drawing set. Each TCP shall have laminated drawings specific to the controlled system served by the TCP.
  6. Complete operator training in the use, programming, and operation of the system.
  7. Deliver flash drive with all device configuration files. Folders and sub-folders must be named and placed in order. For example, building/ahu/floors/vavs.
- F. Start-up of the System:
1. The start-up period starts when the following conditions are met:
    - a. The DDC/EMS system and all involved HVAC equipment have been installed, connected to the DDC/EMS system and are ready to operate.
    - b. A start-up meeting has been conducted with representative of the General Contractor, Architect/Engineer, maintenance staff, and the DDC/EMS Contractor.
    - c. Consensus is reached, by the representatives at the above referenced meeting that it is appropriate for the start-up process to start.
  2. The alarm notifications called by the control system during the start-up period. The Mechanical Contractor and/or DDC/EMS Contractor shall respond to all alarm notifications from the control system and work cooperatively to insure that the building environmental standards are maintained.
  3. The start-up process shall be completed and the warranty period shall start when the following conditions are met.
    - a. All training to be provided as part of the project has been completed.
    - b. No "alarm" or "condition reports" are being generated by the DDC/EMS system for seven (7) calendar days (168 hours) due to incomplete or inaccurate installation or programming.
    - c. All adjustments and "fine tuning" of the system have been completed.

- G. Verification: A written testing and start-up report must be submitted for approval before acceptance. In addition to the DDC/EMS Contractor's testing and start-up report, the Owner may independently verify the test results. The report on test results shall include setpoints and operating ranges of all components.

### 3.2 DEVICE INSTALLATION

- A. RS 485 Termination: Polarity must be maintained from controller to controller. Strip cable sheath 1.5", strip conductors .25". The shield should be grounded at the network controller or router and nowhere else along the field bus. Continuity of the shield must be maintained over the entire length of the cable. The shield terminal can be used as a tie point for the shield only if the shield terminal is not internally grounded within the controller.
- B. Topology: Mandatory field devices installed in a daisy chain or bus topology. Star configurations not allowed. Tee configurations not allowed. Ring configurations not allowed. Stubs are not allowed.
- C. Transceiver Loading: If only isolated transceivers are connected on the field bus, the total number of unit loads is 48. If the field bus contains a non- isolated transceiver, the total number of unit loads is 32. The Controllers total unit load is summation of the transceiver and the adapter circuit. One Unit Load is 12,000 Ohms. To calculate unit loading use,  $UL=12,000/X$ , where X is the total impedance from the transceiver and the adapter circuit. Provide field bus loading calculation on submittal drawings.
- D. Biasing and End of Line Use Johnson Controls MS-BACEOL-0 end of line resistor. The End of line resistor shall be installed at both ends of the field bus. Do not connect the REF wire to the field bus shield. If and only if all controllers are on the field bus are fail-safe and isolated transceivers, then a 120 Ohm resistor can be installed at both ends of the field bus. The allowable cable length for these conditions is 4000 feet regardless of AWG. If Johnson Control MS-BACEOL-O end of line resistors are used for the biasing and end of line resistance, the pair will exert a total of 23.5 units of load on the field bus.
- E. BACnet Ethernet/IP: Use Blue Cat-6A cable. Terminate using T568B configuration. Maximum length is 300 feet between devices. Mandatory field devices installed in a daisy chain or bus topology. Star configurations not allowed. Tee configurations not allowed. Ring configurations not allowed. Stubs are not allowed.
- F. Device Communication Parameters: Instance Number: (NNNCDD). No duplicate instance numbers for entire district.

N = Network Number

C = Communication Type (0= MS/TP, 1= IP)

D = Device MAC address

I.E. The instance number of an IP router on network 26 = 26100

I.E. A MS/TP device 43 on network 26 = 26043

MAC address = sequential along field bus segment, no duplicate MAC address on field bus. Skip address 1. Network controller or router shall be address 0.

Max Master = Highest MAC address+ 2

Baud Rate = 9.6 kB thru 76.8 kB. Preferred 38.4kB.

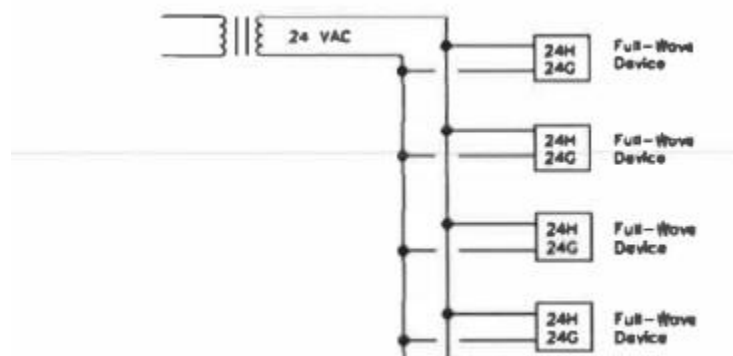
ADPU = 6000 ms

ADPU retries = 2

### 3.3 TRANSFORMER WIRING INSTALLATION

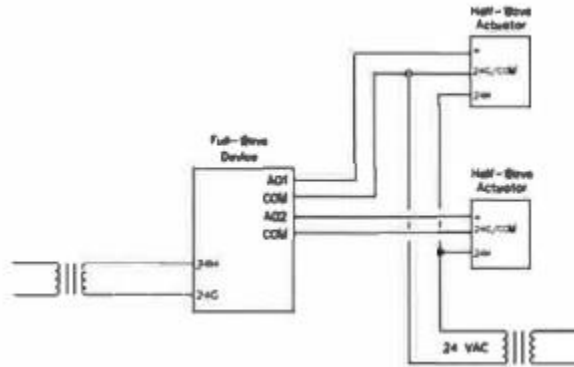
A. Equipment damage can occur when a common transformer is used to power non-isolated, half wave rectifier and non-isolated, full wave rectifier devices. Equipment damage can also occur if the I/O terminals of a device lack isolation from one another and I/O devices of varying rectifier types are connected to these non-isolated terminals and powered from a common transformer. Devices with internally isolated power supplies may share a common transformer. Full-wave devices may share a common transformer as long as there is no interconnections between I/O devices supplied by the common transformer. Half-wave devices may share a common transformer as long as wiring polarity is maintained.

1. Power Multiple Full-wave Controllers from a Single Transformer.
  - a. There is no interconnections between the universal inputs, digital inputs, digital outputs, or analog outputs of any of the controllers powered by the common transformer.
  - b. None of the I/O devices connected to the controllers are power by the same transformer supplying the controllers unless the I/O devices have interlay isolated power supplies.

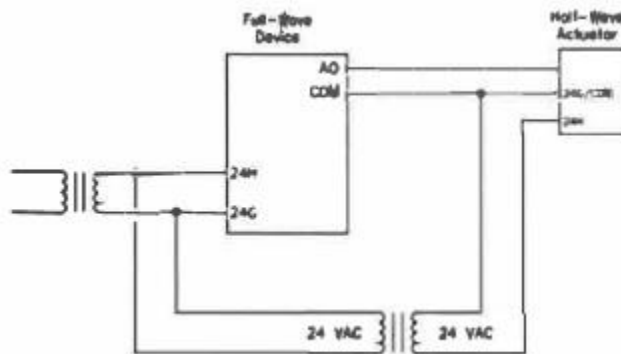


2. Use Separate Transformers to Power Full-Wave Controllers and Half- Wave Actuators.
  - a. A full-wave controller connected to half-wave actuators must be powered by separate transformers. One or more half-wave

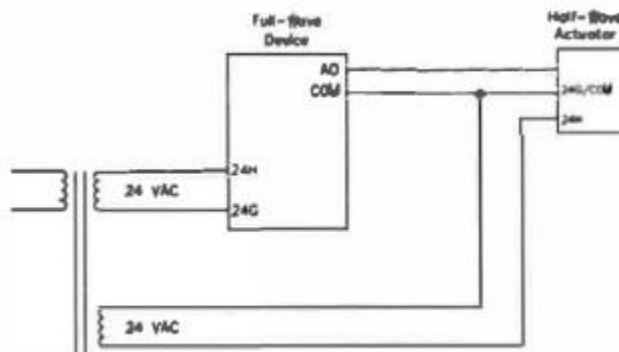
actuators may share a transformer by the full-wave controller must have its own separate transformer.



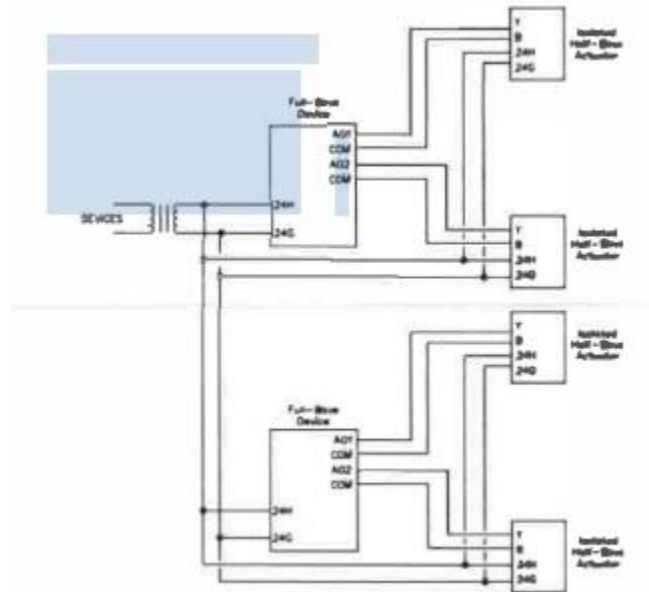
3. Use a One-to-One Transformer to Isolate Full-wave Controller and Half-Wave Actuator.
  - a. A transformer with a one-to-one ratio may be used for isolation purposes.



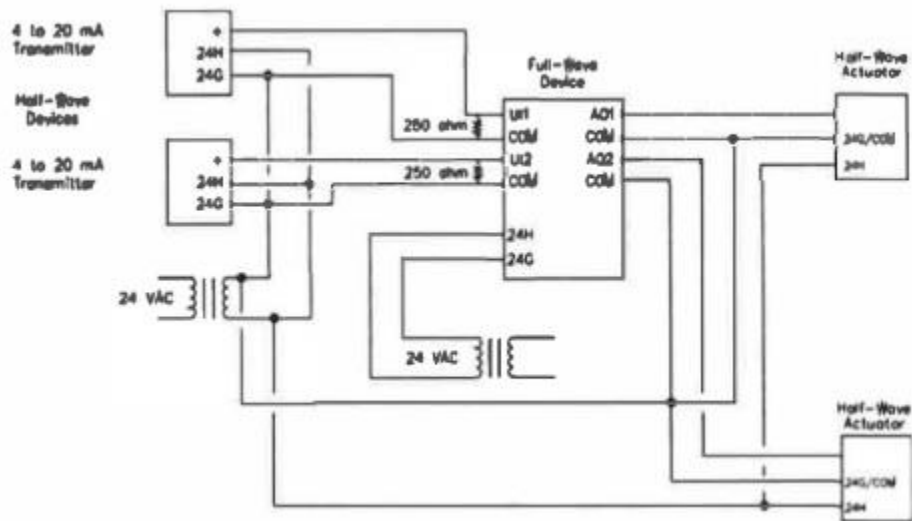
4. Provide Isolation with a Dual Secondary Transformer:



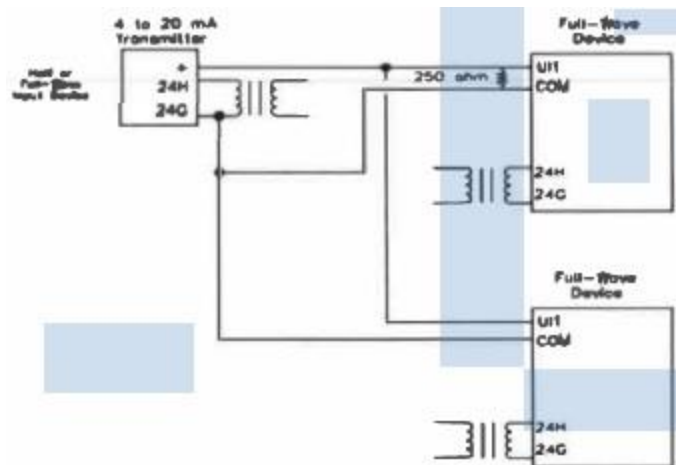
5. Use a Single Transformer to Power a Full-Wave Controller and Isolated, Half-Wave Actuators.



6. Use Separate Transformers for Half-Wave Actuators and Full-wave Controllers.



7. Use Separate Isolation Transformers to Power a Single Input Device Connected to Multiple Full-Wave Controllers.



### 3.4 FIELD WIRING

A. The table below is to be used for all DDC wiring:

Use Copper Conductors Only

Signal Type	Color	Plenum	Shield	Size	Conductors
Analog Input	Blue	Yes	Yes	18	2
Analog Input w/ Power	Yellow	Yes	Yes	18	4
Digital Input	Purple	Yes	No	18	2
Analog Output	Green	Yes	Yes	18	2
Analog Output w/ Power	Pink	Yes	Yes	18	4
Digital Output	White	Yes	No	18	2
Digital Output w/ Power	Orange	Yes	No	18	3
BACnet	Blue	Yes	Yes	22-24	2
ModBus	Yellow	Yes	Yes	22-24	2
LonWorks	Orange	Yes	No	22	2

### 3.5 PANEL WIRING

A. The table below is to be used for all wiring inside DOC Panels:

Use Copper Conductors Only

Voltage	I/O Type	Color	AWG
Low Voltage	AI	YEL	16
	DI	PUR	16
	AO	PINK	16
	DO	BLU	16
	COM	GRY	16
	+24VDC	RED	16
	-24VDC	BLK	16
	24H	BRN	16
	24G	ORG	16
	GND	GRN	16
Line Voltage	120V	BLK	12
	120N	WHT	12
	GND	GRN	12

- 3.3 SEQUENCE OF OPERATION: The below sequences of operation are to be used as a primary guideline for DDC/EMS control logic sequence development. Any/all variations from the below operation sequences must be approved by the District's DDC/EMS operator prior to implementation. All fans providing ventilation to meet minimum outside air requirements shall run continuously during occupied hours. Airside equipment (air handlers, etc.) shall start by normally open relay and signal from DDC/EMS.
- A. Fan Status Sensors: If Fan Status Sensors are installed, they will not be interlocked to the cooling/heating call or heat/cool valve operation in the DDC/EMS control logic. These sensors are extremely prone to failure and often cause a no heat or no cool situation when the actual unit is fully functional.
  - B. Outside and Return Air Damper Minimum Airflow Set Points: The Control Contractor shall set the outside air damper position airflow set points per design and air balance.
    - 1. CO2 Reset of Minimum Outside Air: The reset of the minimum outside air setpoint shall be based on the CO2 sensor with the greatest demand.
    - 2. CO2 Sensor Set Points: The Control Contractor shall determine the base ambient CO2 concentration level after the air handler system has been balanced and the building is unoccupied. The upper and lower CO2 concentration set points shall be developed as follows:  
 The lower CO2 concentration set point shall be 200 ppm (adj.) above the base ambient CO2 concentration level.  
 The upper CO2 concentration set point shall be 600 ppm (adj.) above the base ambient CO2 concentration level.
  - C. Heating/Cooling Unit (HP): (Heating setpoint 72°F, Cooling setpoint 75°F) The unit shall be enabled per the system operation schedule through the DDC/EMS. A wall mounted room thermostat with subbase having fan-auto-on and heat-auto-off switches shall control the unit to maintain cooling or heating setpoints. The thermostat shall start the fan and unit cooling at 2°F (adj.) above setpoint and run to 2°F (adj.) below setpoint for cooling



and then stop. The thermostat shall start the fan and unit heating at 2°F (adj.) below setpoint and run to 2°F (adj.) above setpoint for heating and then stop. The unit shall be capable of economizer operation. The DDC/EMS shall monitor supply air temperature through a duct mounted temperature sensor and the room temperature through a wall mounted temperature sensor. The DDC/EMS shall monitor the unit fan status with a current sensor and the supply air temperature. The current sensor shall differentiate between a motor failure and a belt failure and the DDC/EMS shall indicate the type of failure. If the bypass button on the room temperature sensor is activated, the heating/cooling unit shall start for two hours (adj.).

- D. Exhaust Fans: Fan shall start/stop by DDC/EMS. DDC/EMS shall monitor fan status with a current sensor.
- E. Split System Air Conditioner (ODU/IDU): (Cooling setpoint 75°F) The system shall operate continuously. A factory furnished controller to be mounted on the wall shall control system operation. The control contractor shall provide the interlock wiring between the controller and the indoor unit, and the interlock wiring between the indoor and outdoor unit. Power wiring between the outdoor unit and indoor unit shall be by others. A wall mounted temperature sensor without bypass button or adjustable setpoint switch next to the controller shall monitor room temperature and shall alarm DDC/EMS if room temperature rises above 85°F (adj.). DDC/EMS shall monitor system status with current sensors (one each for ODU and IDU).
- F. Domestic Hot Water Circulating Pump (CP-1): Shall start/stop by DDC/EMS. DDC/EMS shall monitor pump status with a current sensor.
- G. Provide monitoring points for the following plumbing equipment:  
WH-1 Water Heater: Run Time Contact, Alarm Contact

**END OF SECTION**

## SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:

1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including connection to existing Campus fire alarm system with monitoring equipment and wiring for central station connection. Provide fire alarm system product submit for approval by the AHJ.
3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, lamps, dimmers, supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
4. Electrical and Communications distribution site work as shown. Provide conduits, raceways, trenching, backfilling, pull boxes, vaults, equipment pads and substructures..
5. Duct banks and raceways for all power and communications systems as shown and/or required. Duct banks shall include all trenching, racking, conduit, concrete, backfill, boxes, pads, substructures required for a fully developed and useable pathway for cables, conductors, as shown on site, etc.
6. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices.
7. Plumbing Electrical: Conduit, conductors and terminations for plumbing equipment with power requirements including necessary fusible and/or non-fusible safety disconnect devices. Provide motor starters where required unless provided by mechanical specification.
8. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
9. Data systems infrastructure including all boxes, raceways, cable tray, wire basket tray, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in

plans, risers, specifications, EIA/TIA standards and/or required for a complete and operating system.

10. Lighting acceptance testing, documentation and completion of required forms as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
11. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.

B. Related Sections Under Other Divisions:

1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
3. Irrigation System: Provide all line voltage (50 volts or above) connections to irrigation system equipment, time clocks and or powered satellite controls. Coordinate locations of this work with the Landscape Contractor.
4. Pole Bases: Contractor shall be responsible to furnish light standard concrete pole bases, rebar, bolt templates and anchor bolt kits for a complete installation. Concrete, rebar, excavation shall be by Contractor in accordance with all parts of this specification.
5. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26 (the DDC systems/EMS systems and components are installed in accordance with Division 25).
6. Smoke Fire Dampers: Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).
7. Duct mounted smoke detectors: Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).
8. Security System: Shall be installed by Owner's vendor. Contractor shall provide conduits, boxes, stubs to accessible ceilings, dedicated circuit(s) for alarm panel, access control system (key pads, electric locks), etc. as shown and/or required by the Owner's vendor.

1.3 SYSTEM DESCRIPTION

- A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.
- B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

#### 1.4 SUBMITTALS AND SHOP DRAWINGS

- A. Before construction, submit in (accordance with the General Conditions of this Specification) a complete list of all materials proposed to be furnished and installed under this section. Any material procured without review and approval of the engineer and/or owner's representative, will solely be at the contractor's risk.
- B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
  - 1. Distribution equipment including main switchboards, distribution switchgear, transformers, distribution panels and breakers, motor controls, distribution and branch circuit panels, grounding, transient voltage surge suppressors, etc.
  - 2. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
  - 3. Lighting equipment including fixtures, lamps, mounting accessories, color charts (where required), etc.
  - 4. Lighting control equipment including controls and switching, switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
  - 5. Constructability review letter/comments for lighting acceptance testing as required by Section 26 56 70, LIGHTING ACCEPTANCE TESTING.
  - 6. Conduit including all fittings, etc.
  - 7. Wiring and cable, terminations, etc.
  - 8. Fire rating penetration materials, details, etc.
- C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.
- D. SUPPORTING DEVICES
  - 1. Provide all details of suspension and support for ceiling hung equipment.
  - 2. Where walls, floor, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the submittals must include spacing, static loads and seismic loads at all attachment and support points.
  - 3. Provide seismic details of seismic restraints and anchors; including number, size and locations for each piece of equipment.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment

delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.
- B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply the current product model or series which meets the specification and intended use of the specified component.

### 2.2 SUPPORTING DEVICES

- A. Hangers: Kindorf B-905-2A Channel, H-119-D washer, C105 strap, 3/8" rod with ceiling flange.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Luminaire Chain: Campbell Chain 75031, 90-lb. test with steel hooks.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.
- B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
  - 1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained

- and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman's valid Pocket Card.
- C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.
- D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.
- E. Supporting Devices:
1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
  2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.
  3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
  4. Support conduits within 18" of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8' spacing.
  5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
  6. Provide seismic bracing per CBC requirements for this building location.
  7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category "SDC" per Structural Engineer.
- F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.
- G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor. A written response to all items shall be submitted for Owner's review once complete. When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.

- H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date on a daily basis reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.
- I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.
- K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.
- L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.
- M. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 56 70, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems.

END OF SECTION

## SECTION 26 05 13 – MEDIUM VOLTAGE CABLES (Above 600 Volts)

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Medium voltage cables (cable for systems above 600 volt).
- B. Related Work:
  - 1. Bedding of conduits: Section 31 2 000, EARTHMOVING.
  - 2. General electrical requirement and items that are common to more than one section of Division 26: Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 3. Conduits for medium voltage cables: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 4. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

## 1.3 SUBMITTALS

- A. Submit in accordance with the general conditions of the specification and Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include splice and termination kit submittal information prior to purchase and installation.
- C. Installer Approval:
  - 1. Employees who install the splices and terminations shall have not less than three years of experience splicing and terminating cables which are equal to those being spliced and terminated, including experience with the materials in the kits.
  - 2. Furnish satisfactory proof of such experience for each employee who splices or terminates the cables to the Inspector of Record (IOR).



#### 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the designation only.
- B. Underwriters Laboratories (UL):
  - 1. 1072-2001 Safety Medium-Voltage Power Cables
- C. National Fire Protection Association (NFPA):
  - 1. 70-2002 California Electrical Code (CEC)
- D. National Electrical Manufacturers Association (NEMA):
  - 1. WC71-99 Standard for Non-Shielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electrical Energy.
  - 2. WC74-20005-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.
- E. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. 48-96 Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 KV Through 765 KV
- F. 386-95 (R2001) Separable Insulated Connector Systems for Power Distribution Systems above 600 V
- G. 404-2000 Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500-500,000 Volts
- H. 592-90 (R1996) Exposed Semi-conducting Shields on High-Voltage Cable Joints and Separable Insulated Connectors

### PART 2 - PRODUCTS

#### 2.1 MATERIAL, MEDIUM VOLTAGE CABLE

- A. Medium voltage cable shall be EPR MV-105, in accordance with the CEC and NEMA WC71, WC74 and UL 1072. Approved manufacturers are General Electric, General Cable, Rome, Okonite, or Engineer approved equal.
- B. Shall be single conductor stranded copper with ground shield and fully jacketed.
- C. Insulation:
  - 1. Insulation level shall be 133 percent.
  - 2. Types of insulation:
    - a. Cable type abbreviation, EPR: Ethylene propylene rubber insulation shall be thermosetting, light and heat stabilized.
    - b. Cable type abbreviation, CCLP: Polyethylene insulation shall be thermosetting, light and heat stabilized, chemically crosslinked.
- D. Conductors and insulation shall be wrapped separately with semiconducting tape.

- E. Insulation shall be wrapped with non-magnetic, metallic shielding.
- F. Heavy duty, overall protective jackets of chlorosulphonated polyethylene, neoprene or polyvinyl chloride shall enclose every cable.
- G. Cable temperature ratings for continuous operation, emergency overload operation and short circuit operation shall be not less than the NEMA WC71 or WC74 Standard for the respective cable.
- H. Manufacturer's name and other pertinent information shall be marked or molded clearly on the overall outside surface of the jackets, or incorporated on marker tapes within the cables at reasonable intervals.

## 2.2 MATERIAL, SPLICES AND TERMINATIONS

- A. The materials shall be compatible with the conductors, insulations and protective jackets on the cables and wires. Approved manufacturers are 3M, Elastimold, Raytheon or approved equal.
- B. The splices shall insulate and protect the conductors not less than the insulation and protective jackets on the cables and wires which protect the conductors. In locations where moisture might be present, the splices shall be watertight. In manholes and handholes the splices shall be submersible.
- C. Splicing and Terminating Fittings: Shall be in accordance with IEEE 386, 404 and 592.
  - 1. Shall be heavy duty, pressure type fittings, which will assure satisfactory performance of the connections under conditions of temperature cycling and magnetic forces from available short circuit currents.
  - 2. The fittings shall be suitably designed and the proper size for the cables and wires being spliced and terminated. Terminations to bus shall be with two hole lugs.
- D. Splicing and Terminating Kits:
  - 1. General:
    - a. Shall be assembled by the manufacturer or supplier of the materials and shall be packaged for individual splices and terminations or for groups of splices and terminations.
    - b. Shall consist of materials designed for the cables being spliced and terminated and shall be suitable for the prevailing environmental conditions.
    - c. Shall include detail drawings and printed instructions for each type of splice and termination being installed, as prepared by the manufacturers of the materials in the kits.
    - d. Detail drawings, and printed instructions shall indicate the cable type, voltage rating, manufacturer's name and catalog numbers for the materials indicated.
    - e. Voltage ratings for the splices and terminations shall be not less than the voltage ratings for the cables on which they are being installed.
    - f. Shall include shielding and stress cone materials.
  - 2. Epoxy resin kits shall be as follows:
    - a. Compatible with the cable insulations and jackets and make the splices watertight and submersible.
    - b. Thermosetting and generate its own heat so that external fire or heat will not be required.

- c. Set solid and cure in approximately 60 minutes in 21 degree C (70 degree F) ambient temperature.
  - d. Not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.
  - e. Furnished in pre-measured quantities, sized for each splice and each termination, with two resin components in an easy mixing plastic bag which will permit mixing the resin without entrapping air or contaminants. Other methods of packaging and mixing the epoxy resin components will be considered for approval, provided they include adequate safeguards to assure precise proportioning of the resin components and to prevent entrapping air and contaminants.
  - f. Use snap-together, longitudinally-split, interlocking seam, transplant mold bodies or taped frameworks, injection fittings and injection gun or pouring equipment. Completely fill voids within the splices and terminations.
- E. Premolded Rubber Splices and Terminations:
- 1. Splices and terminations shall be in accordance with IEEE 48, 386, 404 and 592.
  - 2. Premolded rubber devices shall have a minimum of .125" semiconductive shield material covering the entire housing. Test each rubber part prior to shipment from the factory.
  - 3. Grounding of metallic shields shall be accomplished by a solderless connector enclosed in a watertight rubber housing covering the entire assembly. The grounding device and splice or terminator shall be of same manufacturer to insure electrical integrity of the shielded parts.
  - 4. The premolded parts shall be suitable for indoor, outdoor, submersible, or direct burial applications.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, HIGH VOLTAGE CABLE

- A. Installation shall be in accordance with the CEC, and as shown on the drawings.
- B. Use suitable lubricating compounds on the cables and wires to prevent damage to them during pulling in. Provide compounds that are not injurious to the cable and wire jackets and do not harden or become adhesive.
- C. Splicing of cables is allowed only with prior approval from the engineer. Splice the cables and wires only in manholes and accessible junction boxes where unavoidable. Ground shields in accordance with Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- D. In manholes, trenches and vaults install the cables on suitable porcelain insulators with steel cables racks. Ground cable racks in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- E. In manholes, underground raceways and other outdoor locations:
  - 1. Seal the cable ends prior to pulling them in to prevent the entry of moisture.
  - 2. For ethylene propylene rubber and polyethylene insulated cables, use bags of epoxy resin which are not less than 1/4" larger in diameter than the overall diameter of the cable. Clean each end of each cable before installing the epoxy resin over it.

### 3.2 INSTALLATION, SPLICES AND TERMINATIONS

- A. Install the materials as recommended by their manufacturer including special precautions pertaining to air temperature during installation.
- B. Ethylene Propylene Rubber and Polyethylene Insulated Cables:
  - 1. Cables rated 8000 volts or less: Install epoxy resin splices and terminations, or premolded rubber splices and terminations.
  - 2. Cables rated more than 8000 volts: Install premolded rubber splices and terminations.
- C. Installation shall be accomplished by qualified personnel trained to accomplish high voltage equipment installations. All instructions of the manufacturer shall be followed in detail.

### 3.3 FEEDER IDENTIFICATION

- A. In each manhole and pullbox install permanent tags on each circuit's cables and wires to clearly designate their circuit identification and voltage. In manholes the tags shall be the embossed brass type and shall also show the cable type and voltage rating. Position the tags so they will be easy to read after the fireproofing is installed. See Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

### 3.4 FIELD TESTS FOR MEDIUM VOLTAGE CABLE

- A. New Cable:
  - 1. Acceptance tests shall be performed on new cable in accordance with IEEE 48 and as specified herein.
  - 2. Test new cable after installation, splices, and terminations have been made, but before connection to equipment and existing cable.
- B. High Potential Test:
  - 1. Leakage current test shall be by high potential DC step voltage method.
  - 2. Prior to high potential test, test the cable and shields for continuity, shorts, and grounds.
  - 3. High potential test shall measure the leakage current from each conductor to the insulation shield. Use corona shields, guard rings, taping, mason jars, or plastic bags to prevent corona current from influencing the readings. Unprepared cable shield ends shall be trimmed back 1" or more for each 10 kV of test voltage.
- C. Safety Precautions:
  - 1. Exercise suitable and adequate safety measures prior to, during, and after the high potential tests, including placing warning signs and preventing people and equipment from being exposed to the test voltages.
- D. Test Voltages:
  - 1. New shielded EPR and CCLP cable DC test voltages shall be as follows:

Rated Circuit Voltage Phase-to-Phase Volt	Wire Size AWG or MCM	Test Voltage KV	
		100 percent Insulation Level	133 percent Insulation Level

2001-5000	8-1000	25	25
5001-8000	6-1000	35	35
8001-15000	2-1000	55	65
15001-25001	1-1000	80	100

E. High Potential Test Method:

1. Apply voltage in approximately 8 to 10 equal steps.
2. Raise the voltage slowly between steps.
3. At the end of each step, allow the charging currents to decay, and time the interval of decay.
4. Read the leakage current and plot a curve of leakage currents versus test voltage on graph paper as the test progresses. Read the leakage current at the same time interval for each voltage step.
5. Stop the test if leakage currents increase excessively or a "knee" appears in the curve before maximum test voltage is reached.
  - a. Repair or replace the cable and repeat the test.
6. Upon reaching maximum test voltage, hold the voltage for five minutes. Read the leakage current at 30 second intervals and plot a curve of leakage current versus time on the same graph paper as the step voltage curve. Stop the test if leakage current starts to rise, or decreases and again starts to rise. Leakage current should decrease and stabilize for good cable.
7. Terminate test and allow sufficient discharge time before testing the next conductor.

F. The contractor shall furnish the instruments, materials and labor for these tests and forward the results in a single bound copy to Engineer, indicating compliance with specification and manufacturers installation requirement.

END OF SECTION

SECTION 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
  - 1. Wires and cables.
  - 2. Connectors.
  - 3. Lugs and pads.

1.3 SYSTEM DESCRIPTION

- A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Provide product data for the following equipment:
  - 1. Wires.
  - 2. Cables.
  - 3. Connectors.
  - 4. Lugs.
  - 5. Splice Kits.
  - 6. Strain Relief Fittings.
  - 7. Cable Racking and Insulators.
- C. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).
- B. Furnish products listed by UL or other testing firm acceptable to AHJ.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.
- B. Connectors: Burndy, IlSCO, Thomas & Betts, or approved equal.
- C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.
- D. Splices:
  - 1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
  - 2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
  - 3. Screw Terminal Lugs.
  - 4. Kearney Split Bolt.

### 2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:

- A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
- B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.
- C. Color Code Conductors as Follows:
 

PHASE	208 VOLT	480 VOLT
A	Black	Brown
B.	Red	Orange
C.	Blue	Yellow
Neutral	White	White w/ colored strip
Ground	Green	Green
- D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.

- E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.
- F. Refer to signal and communications specification sections for cable requirements.

## 2.3 CONNECTORS

- A. Copper Pads: Drilled and tapped for multiple conductor terminals.
- B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.
- C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

## 2.4 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.
- B. Insulation: Use proper insulation types where temperature and environment are a factor.
- C. Splices at or below grade level shall be made with wet location rated and approved mechanical connectors and shall be encapsulated in epoxy or plastic molded poured kits. The connections must be assured to be watertight. Splices at or below grade shall always be avoided and minimized. Prior approval is required for feeder splices below grade. Submit proposed materials and exhibit showing location of intended splices for Engineer's review and approval prior to commencing with the work.
- D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In manholes and vaults, provide embossed



brass tags identifying system serviced and function. See Section 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS.

- E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.
- F. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.
- G. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.
- H. Wires and Cables:
  - 1. Conductor Installation:
    - a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
    - b. Install conductors with care to avoid damage to insulation.
    - c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
    - d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
  - 2. Conductor Size and Quantity:
    - a. Install no conductors smaller than 12AWG unless otherwise shown.
    - b. Provide all required conductors for a fully operable system.
  - 3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
    - a. Power and Lighting branch circuits.
    - b. Ground fault and arc fault protected circuits where a GFI and arc fault breakers are used in panelboards.
    - c. Other electronic equipment which produces a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, where indicated.
  - 4. Conductors in Cabinets:
    - a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
    - b. Tie and bundle feeder conductors in wireways of panelboards.
    - c. Hold conductors away from sharp metal edges.
    - d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

### 3.2 FIELD QUALITY CONTROL

- A. Tests:
  - 1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.

2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION

## SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
  - 2. “Grounding electrode system” refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
  - 3. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
  - 3. Section 26 12 00, MEDIUM VOLTAGE TRANSFORMER.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

## PART 2 - PRODUCTS

## 2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

- C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

## 2.2 GROUND RODS

- A. Copperclad steel, 5/8" diameter by 10' long, conforming to UL 467 unless otherwise noted on drawings and details.
- B. Quantity of rods shall be as required to obtain the specified ground resistance or additional rods shall be driven to obtain specified resistance or less.

## 2.3 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

## 3.2 INACCESSIBLE GROUNDING CONNECTIONS

- A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

## 3.3 SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
  - 1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental

- or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear:
1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
  2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
  3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
  2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to nearest component of the grounding electrode system and the ground bar at the service equipment.
- F. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
  2. Non metallic conduit systems shall contain an equipment grounding conductor.
  3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
  2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
  3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures

connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

### 3.4 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

### 3.5 TELECOMMUNICATIONS SYSTEM

- A. Bond telecommunications system grounding equipment to the electrical grounding electrode system. Refer to Section 27 13 00, INTERCOMMUNICATIONS SYSTEMS.

### 3.6 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 25 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met and test results shall be submitted to the Owner with final close out documents.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Below-grade connections shall be visually inspected by the IOR prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.
- D. Furnish a copy of tests to Owner at completion of project.

### 3.7 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 8' in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

### 3.8 GROUNDING FOR RF/EMI CONTROL

- A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4" wide copper strip or two No. 10 copper conductors spaced minimum 4" apart. Use No. 6 copper where exposed and subject to damage.
- B. Comply with the following when shielded cable is used for communication circuits.
  - 1. Shields shall be continuous throughout each circuit.
  - 2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
  - 3. Do not connect shields from different circuits together.
  - 4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

END OF SECTION

## SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Cabinets, termination cabinets.
6. Gutters.
7. Concrete boxes and vaults.

## B. Related Work:

1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, site and building communications, controls, fire alarm, security, access control, sound systems, data system, energy management systems, power distribution, lighting, lighting controls, video, CATV, voice communications, HVAC and other building low voltage/communications systems controls as may be required. .
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor's responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.



6. It is the Contractor's responsibility to insure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
7. Trenching and backfilling for all underground conduit systems installed by the Electrical Contractor shall be the responsibility of the Contractor. Medium Voltage Conduits shall have minimum cover requirement of 36" below finish grade. Low Voltage systems and communications conduits shall have minimum cover requirement of 24" below finish grade minimum. More stringent depth requirements may be imposed by the local agency shall be adhered to, and / or this specification or as detailed on the plans. Joint trenching may be utilized where practicable and where permitted by this specification. Concrete, native material and sand shall be used as backfill material and shall be compacted in accordance with and coordinated with the grading and site preparation requirements. Conduits shall rest in a minimum of 4" bed of sand prior to backfill and compaction. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation.
8. Minimum conduit size shall be 1/2" except if plan shows or code requires larger size. Exception: Use minimum 3/4" for underslab and below grade applications outside of building exterior walls.
9. All electrical, control, communications systems shall be installed in metallic conduit system. This shall include but not be limited to all systems described in Section B.3 above, except for voice and data systems which shall be installed as described on these plans and as specified here-in but shall not be less than the recommendations of EIA/TIA standards.
10. All line voltage wiring within the building shall be installed in metallic conduit.
11. All conduit, concrete pads, underground concrete substructures shall be furnished and installed with the approved materials and type for the application. Provide proper traffic control during construction as well as barriers and protection of all excavations and trenching.
12. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
13. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
14. All low voltage systems including fire alarm, public address, etc. shall be in dedicated conduit systems. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 13 00, INTERCOMMUNICATIONS SYSTEMS and as recommended by EIA/TIA standards. It shall be the contractor's responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
15. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.
16. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
17. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed.
18. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked,

and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.

19. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
20. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
21. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
22. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

### 1.3 SUBMITTALS

- A. Provide Shop Drawings and Product Data for the Following Equipment:
  1. Conduit and fittings.
  2. Outlet boxes.
  3. Weatherproof outlet boxes.
  4. Junction and pull boxes.
  5. Floor boxes.
  6. Cabinets, termination cabinets.
  7. Gutters.
  8. Concrete boxes and vaults.
  9. Putty pads.
  10. Raceways

### 1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or other independent and nationally recognized testing firm.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

- C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
- D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
- E. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.
- F. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.
- G. Wire basket tray shall be 12" wide with 4" side rails unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.
- H. Cable runway tray shall be 12" wide with 2" side rails unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. Material shall be hollow steel with gray painted finish.
- I. Manufacturers:
  - 1. Outlet Boxes: Bowers, Raco, Steel City or equal.
  - 2. Weatherproof Outlet Boxes: Bell, Red Dot, [Carlon] or equal.
  - 3. Floor Boxes: Legrand - Wiremold/Walker, Hubbell, Steel City, or equal.
  - 4. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
  - 5. Box Extension Adapter: Bell, Red Dot, [Carlon] or equal.
  - 6. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
  - 7. Vaults: Christy, Brooks, Utility Vault or equal.
  - 8. Putty pads: 3M, Hilti, or equal.
  - 9. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
  - 10. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
  - 11. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
  - 12. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
  - 13. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
  - 14. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liqueatite or equal.
  - 15. Wire basket tray, B-line, GS Metals, Cablofil or equal.
  - 16. Cable runway tray, B-line, CPI, Homaco or equal.
  - 17. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
  - 18. Exterior In-Grade Boxes for Non-Utility Company, Precast concrete or polymer concrete, Utility Vault and Christy.

## 2.2 OUTLET BOXES

- A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.
- B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as "MYERS" gasketed type hub or equal.
- C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4" square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal.
- D. Luminaire Outlet: minimum 4" square with correct plaster ring depth, minimum 1 1/2" deep with 3/8" luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.
- E. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.
- F. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.
- G. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

## 2.3 WEATHERPROOF OUTLET BOXES

- A. Surface mounted die cast aluminum device boxes shall be provided with screw holes to accommodate cast device covers.
- B. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner. Weatherproof boxes in wet locations as described in CEC 406.8 (B) shall be provided with a "while-in-use" cover; red dot 'CK' Series of aluminum die-cast construction, NEMA 3R, with lacquer finish.

## 2.4 JUNCTION AND PULL BOXES

- A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.
- B. Location:
  - 1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
  - 2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
  - 3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24" shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
  - 4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

## 2.5 BOX EXTENSION ADAPTER

- A. Construction: Diecast aluminum.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

## 2.6 CONDUIT FITTINGS

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.
- B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

## 2.7 EXTERIOR IN-GRADE BOXES FOR NON-UTILITY COMPANY USE SHALL BE:

- A. Precast concrete or polymer concrete type with full bottoms and draining into gravel drywell. Open bottom splice/pull boxes 24" x 36" and smaller shall be open bottom, with minimum 12" of gravel below for drainage.
- B. Flushmount in hardscape and 1" above grade in softscape.
- C. Provided with correct traffic type lid, i.e., full vehicular, intermediate incidental vehicular or pedestrian-rated as applicable stamped with "ELECTRIC", "LIGHTING", "COMMUNICATIONS", etc. cover identification as shown on the drawings or as applicable. All boxes or vaults located in streets, driveways, sidewalks wider than 8', and turf areas where mowing takes place shall be traffic rated.

- D. Provided with brass hold-down bolts in cover.
- E. Provided with necessary box extensions to gain proper depth.
- F. Seal all conduit in underground boxes with duct seal after conductors have been installed.

## 2.8 PUTTY PADS

- A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.
- B. Designed to install around outside of outlet boxes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roofmount conduits, where allowed, with approved support blocks in coordination with details on roof requirements or as specified in roofing specification, by the Architect. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8' above finished grade shall be strapped at a minimum of 5' spacing.
- B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Minimum 4" of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints. All non-metallic conduit runs over 150' in length and over 1 1/4" trade size conduit shall utilize galvanized rigid steel elbows.
- C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'-0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above

grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.

- D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel, insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1 1/4" and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.
- E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 30' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6' of flexible metal conduit extending from junction box to fixture. "Master" "Slave" fixtures are permitted to use manufactured flexible cable of longer dimension up to 12' between "Master" and "Slave" only and only as a U.L. listed system component.
- F. Underground conduits and transition to above grade/slab shall be as follows:
1. PVC elbows allowed if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
  2. GRS elbows are required if conduit run is 150' or greater.
  3. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
  4. GRS elbows/risers to be PVC coated or 10 MIL taped wrapped (1/2" lapped) to 3" above finish grade or top of slab.
- G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by

the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

- H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.
- I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).
- J. Conduit Seals: Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
  - 1. Provide damming material around conductors 3" into conduit.
  - 2. Fill 3" of conduit with 3M #2123 sealing compound.
  - 3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
  - 4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
  - 5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
  - 6. Provide cable drip loop minimum 12" high.
- K. Marker tape: Place plastic yellow marker tape at 12" above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.
- L. Conduits for high voltage (12kv) systems shall be separated from all other conduits by a minimum of 12". All power system conduits shall be separated from low voltage systems by a minimum of 12" when running parallel to each other and no less than 6" when running perpendicular to each other at conduit crossings.
- M. Medium voltage system conduits including 4,000 volt and above, shall be installed in conduit systems or duct banks that are concrete encased by a minimum of 3" of concrete. Depth of conduits shall remain as specified elsewhere in this specification or as required by the CEC.
- N. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.
- O. Duct bank defined here-in shall be four or more conduits in a common trench, conduit spacers and saddles shall be required in all trenches where more than two conduits over 2" in diameter travel in the same trench. Proper spacing between systems as outlined above shall be required and spacers shall be located each 5' (maximum) along trench route from point to point.
- P. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural



plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.

- Q. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.
- R. Expansion Joints
1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
  2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.
- S. Seismic Joints
1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.
- T. Ladder tray shall be used in equipment rooms where shown on the plans. Ladder tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation.
- U. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.
- V. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- W. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- X. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
- Y. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
- Z. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".

2. Outlet above counter (measured to top of outlet box): +46".
  3. Control (light) Switches. (measured to top of outlet box): +48".
  4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
  5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
  6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- AA. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.
- BB. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.
- CC. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION

## SECTION 26 05 53 – IDENTIFICATION OF ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. This Section Includes:

1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
  - a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
    - 1) Enclosures for transformers, switchboards, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
    - 2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
    - 3) Wall switches not within sight of outlet controlled.
    - 4) Special systems such as, but not limited to, telephone, fire alarm, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
    - 5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
2. Conductor and Cable Identification.

## B. Related Work:

1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 05 13 MEDIUM VOLTAGE CABLES.
3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
4. Section 26 13 02, SWITCHES, MEDIUM VOLTAGE (ABOVE 600 VOLTS).
5. Section 26 24 16, PANELBOARDS.
6. Section 26 28 16, ENCLOSED SWITCHES AND CIRCUIT BREAKERS.
7. Section 26 12 00, MEDIUM VOLTAGE TRANSFORMERS.
8. Section 26 24 14, DISTRIBUTION SWITCHBOARD.
9. Section 26 05 34, CABINETS.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT LABEL DESIGNATIONS

- A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.
- B. Panelboard labels showing panel designation, voltage, phase and source.
- C. In accordance with CEC 110.16, provide arc flash protection warning labels on all switchboards, panelboards, distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

### 2.2 MATERIALS

- A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.
- B. For Emergency Equipment: Use engraved white letters over red background.
- C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.
- D. Arc flash labels shall be provided as required by CEC Article 70E.
- E. Conductor tape number markers: ABB Thomas and Betts WM-0-45 Series non-fading permanent adhesive.

## PART 3 - EXECUTION

### 3.1 MOUNTING

- A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.
- B. Conductor tape markers shall be consistently placed for ready conductor identification.

### 3.2 HEIGHTS ON LABELS

- A. Panelboards, Switchboards and Motor Control Centers and Special Systems Enclosures: 1/4" identify equipment designation; 1/8" identify voltage rating and source.
- B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16" identify circuit and load served, including location of equipment.
- C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16" identify load served.

- D. Transformers: 3/16" identify equipment designation; 1/8" identify primary and secondary voltages, primary source and secondary load. Include location of primary source or secondary load if remote from transformer.

### 3.3 WARNING SIGNS

- A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.
- B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16" stroke minimum.
- C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

END OF SECTION

## SECTION 26 09 23 - OCCUPANCY SENSORS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
  - 4. Section 26 27 26, WIRING DEVICES.
  - 5. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

## 1.2 SYSTEM DESCRIPTION

- A. The occupancy sensors shall sense the presence of human activity within the desired space and enable or disable the on/off manual lighting control function provided by local switches.
- B. Upon detection of human activity by the detector, initiate a time delay to maintain the lights on for a preset period of time. Field adjustable time delay setting from 30 seconds to 15 minutes.
- C. Sensors shall have factory set PIR sensing sensitivity for maximum sensitivity. Provide time delay at 10 minutes.
- D. Install system in accordance with manufacturer's recommendations and instructions.
- E. All line voltage sensors, control units, and relays UL listed

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Provide, on reproducible architectural floor plan, a layout of sensors indicating their sensing distribution.
- C. Provide wiring diagrams indicating low voltage and line voltage wiring requirements.

## PART 2 - PRODUCTS

## 2.1 PASSIVE INFRARED SENSORS - GENERAL

- A. The passive infrared sensors shall detect presence, in the floor area being controlled, by detecting changes in the Infrared energy. Detect small movements, i.e., when a person is writing while seated at a desk.
- B. Provide a temperature compensated dual element sensor and a multi element fresnel lens.
- C. The sensor shall utilize DIP switch adjustments for "on" mode operation, time delay, and sensitivity.
- D. Provide a daylight filter which ensures that the sensor is insensitive to short-wavelength infrared waves, i.e., those emitted by the sun.
- E. The sensors not to protrude more than 1 1/2" from the wall or ceiling and should blend in aesthetically.
- F. Conceal adjustments and mounting hardware under a removable cover to prevent tampering with adjustments and hardware.
- G. Low Voltage Sensors:
  - 1. Sensor shall provide complete coverage of the controlled area.
  - 2. Sensors shall operate on 24VDC power.
  - 3. Sensors shall operate remote power switch packs.
  - 4. Sensors can be wired in parallel to allow coverage of large areas.
  - 5. Manufacturers: Acuity Sensor Switch, The Watt Stopper, Leviton or approved.
- H. Wall Switch Sensors:
  - 1. 300 sq. ft. area coverage, with a field of view of 180 degrees.
  - 2. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, a latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.
  - 3. Rated to switch loads from 0 to 800 watt incandescent or fluorescent 120 volt and 0 to 1000 watts for 277 volt.
  - 4. Provide adjustable daylight feature that holds lighting "off" when a desired footcandle level is present.
  - 5. Provide integral off override switch with no leakage current to the load or ground.
  - 6. Provide hard 1mm poly IR2 lens, soft lens is not acceptable.
  - 7. Provide dual relay when operating lighting and room exhaust fan.
  - 8. Manufacturers: Acuity Sensor Switch, The Watt Stopper, Leviton or approved.

## 2.2 ULTRASONIC OCCUPANCY SENSORS

- A. The occupancy sensors capable of detecting presence, in the controlled floor area by detecting Doppler shifts in transmitted ultrasound.

- B. Occupancy sensors are precision crystal controlled and shall not interfere with each other when two or more are placed in the same area. Provide ultrasonic circuit with solid state crystal controlled with advanced signal processing.
- C. Furnish each sensor with a convenient shunt provision enabling an individual to bypass the sensor in the event of failure. This bypass provision pin or device shall remain in the sensor and be visible from the floor as a constant reminder that the automatic function has been bypassed.
- D. Ceiling mounted with maximum protrusion of 1.5" and blend in aesthetically with the ceiling.
- E. Provide multi-directional transmitter and ultrasonic receivers that are temperature and humidity resistant.
- F. Sensors can be wired in parallel to allow coverage of large areas.
- G. Sensitivity adjustment shall range from off at "0" to maximum at "10."
- H. Sensors shall operate on 24VDC power.
- I. UL listed power pack consisting of a transformer and contact closure relay in one package. Provide a transformer that is capable of operating up to three occupancy sensors.
- J. Manufacturers: Acuity Sensor Switch, The Watt Stopper, Leviton or approved.

## 2.3 DUAL TECHNOLOGY SENSORS

- A. Utilize same technologies as passive infrared and ultrasonic.
- B. Upon a person entering a space, motion from both technologies must be sensed before lighting will be turned on. After this has occurred, detection by either technology will hold lighting on for the set time period. Sensor shall have a retrigger time delay where only one motion is necessary to turn on the lights within 5 seconds after turning off.
- C. Manufacturers: Acuity Sensor Switch, The Watt Stopper, Leviton or approved.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install occupancy sensors as directed by manufacturer's instructions. Complete all electrical connections to all control circuits, occupancy sensors, power supply pack and low voltage wiring.
- B. Verify with manufacturer's representative that the sensors are laid out in compliance to manufacturer's published sensing distribution. Provide additional sensors for complete coverage of the space being sensed.



### 3.2 QUALITY CONTROL

- A. Use manufacturer's published testing and adjusting procedures to adjust sensors time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Owner.

END OF SECTION

## SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components:
  - 1. System Software Interfaces
    - a. Management Interface
    - b. Visualization Interface
  - 2. System Backbone and Integration Equipment
    - a. System Controller
    - b. Digital Time Clock
  - 3. Wired Networked Devices
    - a. Auxiliary Input/Output Devices
    - b. Photocell Sensors
    - c. Relay and Dimming Panel
  - 4. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
  - 5. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

## 1.2 SUBMITTALS

- A. Submittal shall be provided including the following items.
  - 1. Bill of Materials necessary to install the networked lighting control system.
  - 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
  - 3. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
  - 4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
  - 5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
  - 6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
  - 7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
  - 8. Hardware and Software Operation Manuals.

## 1.3 APPROVALS

- A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

- B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
- C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.

#### 1.4 QUALITY ASSURANCE

- A. Product Qualifications
  - 1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
  - 2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V5.0 or later.
  - 3. System luminaires and controls shall be certified by the manufacturer to have been designed, manufactured, and tested for interoperability.
  - 4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
  - 5. All components and the manufacturing facility where product is manufactured shall be RoHS compliant.
- B. Installation and Startup Qualifications
  - 1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.
- C. Service and Support Requirements
  - 1. Phone Support: Toll-free technical support shall be available. The manufacturer shall provide an online tool to schedule a technical support appointment. Manufacturer shall provide 24/7 emergency support.
  - 2. Remote Support: The manufacturer shall offer remote support capability and the ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects. Cellular connectivity to a networked lighting control systems shall be optionally available to provide remote support within the continental United States.
  - 3. Onsite Support: The manufacturer shall offer onsite support that is billable.
- D. Service Contracts:
  - 1. The manufacturer shall be capable of providing service contracts for continued support of the lighting control system post installation, including:
    - a. Remote and onsite emergency response based on first availability
    - b. Remote system performance checks
    - c. Remote diagnostics
    - d. Replacement parts
    - e. The manufacturer shall be capable of providing a 72-hour, onsite response time within the continental United States if required.

#### 1.5 LIGHTING CONTROL MANUFACTURER POLICIES

- A. Shall provide a clear and documented method to contact them regarding a vulnerability and should have a dedicated Product Security Incident Response function.

- B. Shall build its security risk, governance and compliance infrastructure leveraging standards-derived policies, industry best practices and guidelines.
- C. Shall make available a written description or provide documentation describing a security vulnerability policy.
- D. Shall make available a written description or provide documentation describing a security response plan.
- E. Shall make available a means to accept external security vulnerability notifications.
- F. Shall reply within two business days of receiving a vulnerability notification.
- G. Shall be SOC 2 Type 1 or Type 2 compliant.

#### 1.6 PROJECT CONDITIONS

- A. Only install indoor equipment after the following site conditions are maintained:
  - 1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
  - 2. Relative Humidity: less than 90% non-condensing
- B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.
- C. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

#### 1.7 WARRANTY

- A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- B. The hardware warranty shall cover repair or replacement of any defective products within the warranty period.

#### 1.8 MAINTENANCE & SUSTAINABILITY

- A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

### PART 2 - EQUIPMENT

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Acuity Brands Lighting, Inc.

- B. Basis of Design System: Acuity Controls nLight

## 2.2 SYSTEM COMPLIANCE

- A. System components shall comply with UL 916 and UL 924 standards where applicable.
- B. System components shall comply with CFR Title 47, Part 15 standards where applicable.
- C. System components shall comply with ISED Canada RSS-247 standards where applicable.
- D. All equipment shall be installed and connected in compliance with NFPA 70.

## 2.3 SYSTEM PERFORMANCE REQUIREMENTS

### A. System Architecture

1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.
2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
3. The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
4. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.
5. System shall be capable of reporting lighting system events and performance data to management software for display and analysis.

### B. Wired Networked Control Zone Characteristics

1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
2. Devices in an area shall be connected via a “daisy-chain” topology. “Hub-and-spoke” topology, requiring all individual networked devices to be connected back to a central component, shall not be permitted, so as to reduce the total amount of network cable required for each control zone.
3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware to reduce the opportunity for improper wiring and communication errors during system installation.
4. Following proper installation and provision of power, all networked devices connected with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).

- a. The “out of box” default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
  - 5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
  - 6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.
  - 7. Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
    - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
    - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.
- C. System Integration Capabilities
- 1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API. The following system integration capabilities shall be available:
    - a. The system shall support “write” messages for control of individual devices, including, but not limited to, control of relay and dimming output.
    - b. The system shall support “write” messages for control of groups of devices through a single command, including, but not limited to, control of relay and dimming output of all devices.
    - c. The system shall support reading of individual device status information.
      - 1) The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell light measurement.
      - 2) All system devices shall be available for polling for devices status.
    - d. The system shall support reading of group status information for occupancy, relay state, and dimming output.
    - e. The system shall support activation of pre-defined system Global Profiles (see Supported Sequence of Operations for further definition of Global Profile capabilities).
  - 2. The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)
- D. Supported Sequence of Operations
- 1. Photocell Sensing Capabilities (Automatic Daylight Sensing)
    - a. Photocell sensing devices shall be configurable to control a local zone.
    - b. The system shall support the following type of photocell-based control:

- 1) Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
2. Schedule Capabilities
  - a. System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.
  - b. System shall support blink warning and timed extension capabilities.
    - 1) The system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule.
    - 2) Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional period of time.
      - a) Timed override/extension duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours
3. Global Profile Capabilities
  - a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
  - b. Global profiles may be scheduled with the following capabilities:
    - 1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
    - 2) Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
    - 3) Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.
    - 4) Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
    - 5) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
  - c. System Global Profiles shall have the following additional capabilities:
    - 1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.
    - 2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
    - 3) Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response),

- response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
- d. A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.

## 2.4 SYSTEM SOFTWARE INTERFACES

### A. Management Interface

1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
3. Management interface shall require all users to login with a User Name and Password, and shall support creation of at least 100 unique user accounts.
4. Management interface shall support at least three permission levels for users: read-only, read & change settings, and full administrative system access.
5. Management interface shall be capable of restricting access for user accounts to specific devices within the system.
6. All system devices shall be capable of being given user-defined names.
7. The following device identification information shall be displayed in the Management interface: model number, model description, serial number or network ID, manufacturing date code, custom label(s), and parent network device.
8. Management interface shall be able to read the live status of a networked luminaire or intelligent control device and shall be capable of displaying luminaire on/off status, dim level, power measurement, device temperature, PIR occupancy sensor status, microphonic occupancy sensor status, remaining occupancy time delay, photocell reading, and active Profiles.
9. Management interface shall be able to read the current active settings of a networked luminaire or intelligent control device and shall be capable of displaying dimming trim levels, occupancy sensor and photocell enable/disable, occupancy sensor time delay and light level settings, occupancy sensor response (normal or vacancy), and photocell setpoints and transition time delays.
10. Management interface shall be able to change the current active settings and default settings for an individual networked luminaire or intelligent control device.
11. Management interface shall be capable of applying settings changes for a zone of devices or a group of selected devices using a single "save" action that does not require the user to save settings changes for each individual device.
12. A printable network inventory report shall be available via the management interface.
13. A printable report detailing all system profiles shall be available via the management interface.
14. All sensitive information stored by the software shall be encrypted.
15. All system software updates must be available for automatic download and installation via the internet.



## 2.5 SYSTEM EQUIPMENT

### A. Wired Networked Relay and Dimming Panel

1. Product Series: ARP
2. Relay and dimming panel shall be available with 4, 8, 12, 16, 24, 32, 40 or 48 individual relays per panel, with an equal number of individual 0-10V dimming outputs.
3. Optional Field Configurable Relays (FCR) used shall have the following required properties:
  - a. Configurable in the field to operate with single-, double-, or triple-pole relay groupings.
  - b. Configurable in the field to operate with normally closed or normally open behavior.
  - c. Provides visual status of current state and manual override control of each relay.
  - d. Listed for the following minimum ratings:
    - 1) 40A @ 120-480VAC Ballast
    - 2) 16A @ 120-277VAC Electronic
    - 3) 20A @ 120-277VAC Tungsten
    - 4) 20A @ 48VDC Resistive
    - 5) 2HP @ 120VAC
    - 6) 3HP @ 240-277VAC
    - 7) 65kA SCCR @ 480VAC
4. 0-10 dimming outputs shall support a minimum of 100mA sink current per output.
5. Relay and dimming outputs shall be individually programmable to support all standard sequence of operations as defined in this specification.
6. Panel shall be UL924 listed for control of emergency lighting circuits.
7. Panel shall power itself from an integrated 120-277 VAC or optional 347VAC supply.
8. Panel shall provide a configurable low-voltage sensor input with the following properties:
  - a. Configurable to support any of the following input types:
    - 1) Indoor Photocell
    - 2) Outdoor Photocell
    - 3) Occupancy Sensor
    - 4) Contact Closure
  - b. Low voltage sensor input shall provide +24VDC power for the sensor so that additional auxiliary power supplies are not required.
  - c. Sensor input supports all standard sequence of operations as defined in this specification.
9. Panel shall include a Digital Time Clock for local schedule control.
10. Panel shall provide a contact closure input for each group of 8-relays that acts as a panel override to activate the normally configured state of all relays (i.e., normally open or normally closed) in the panel. This input is intended to provide an interface to alarm systems, fire panels, or BMS system to override the panel.
11. Panel shall supply current limited low voltage power to other networked devices connected via low voltage network cable.
12. Panel shall be available with NEMA 1 rated enclosure with the following mounting and cover options:
  - a. Surface-mounted for all panel sizes
  - b. Flush-mounted for up to 16 relay panel sizes
  - c. Screw-fastened for up to 16 relay panel sizes
  - d. Hinged cover with keyed lock for all panel sizes
13. Surface-mounted screw cover options for 8 and 16 relay panel sizes shall be plenum rated
14. Panel shall be rated from 0-50C for 8 and 16 enclosure sizes, and 0-45C for 32 and 48 enclosure sizes.

- B. Control Modules for Low-Voltage Fixtures:
  - 1. Shall be powered by 120 or 277 VAC and be UL2043 listed.
  - 2. Shall be remotely configurable using networked lighting control software.
  - 3. Shall be able to provide UL924-compliant control without the need of an additional, externally-mounted device.

## PART 3 - EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. Installation Procedures and Verification
  - 1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
  - 2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
  - 3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
    - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
    - b. Length
    - c. Insertion Loss
- B. Coordination with Owner's IT Network Infrastructure
  - 1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
    - a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
    - b. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.
- C. Documentation and Deliverables
  - 1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
  - 2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
    - a. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing/scanning drawing files for electronic submission.
    - b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
      - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image: Titleblock Text- Inclusive of room names and numbers, fixture tags and

drawings notes Fixture wiring and homeruns Control devices Hatching or poché of light fixtures or architectural elements

- 2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

### 3.2 SYSTEM STARTUP

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.
  1. For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.
- B. System start-up and programming shall include:
  1. Verifying operational communication to all system devices.
  2. Programming the network devices into functional control zones to meet the required sequence of operation.
  3. Programming and verifying all sequence of operations.
- C. Manufacturer shall be capable of on-site or remote startup and programming.

### 3.3 PROJECT TURNOVER

- A. System Documentation
  1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
  2. Installing contractor to grant access to the owner for the programming database, if requested.
- B. Owner Training
  1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION

## SECTION 26 12 00 – MEDIUM VOLTAGE TRANSFORMERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Padmounted transformers.
  - 2. Padmounted transformers shall be complete, continuous duty, integral assembly, grounded, tamper-resistant, weatherproof, outdoor type with liquid-immersed transformers.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 13, MEDIUM VOLTAGE CABLES (Above 600 Volts): Medium voltage cables.
  - 3. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
  - 4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground currents.

## 1.3 SUBMITTALS

- A. In accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, submit the following:
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, nameplate data, impedance, dimensions, weight, mounting details, decibel rating, termination information, temperature rise, no load and full load losses, regulation, overcurrent protection, connection diagrams, and accessories.
- C. Manuals:
  - 1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
    - a. Identify terminals on wiring diagrams to facilitate installation, maintenance and operation.
    - b. Indicate, on wiring diagrams, the internal wiring for each item of equipment and interconnections between the items of equipment.

- c. Approvals will be based on complete submissions of manuals together with shop drawings.

#### 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Concrete Institute (ACI):
  - 1. 318-02 Building Code Requirements for Structural Concrete.
- C. American National Standards Institute (ANSI):
  - 1. C37.47-00 High Voltage Current-Limiting Type Distribution Class Fuses And Fuse Disconnecting Switches.
  - 2. C57.12.25-90 Transformers-Pad-Mounted, Compartmental-Type, Self Cooled, Single-Phase Distribution Transformers with Separable Insulated High Voltage Connectors; High Voltage, 34500 Grd Y/19920 Volts and Below; Low-Voltage 240/120 Volts; 167 kVA and Smaller-Requirements.
  - 3. C57.12.28-96 Pad-Mounted Equipment Enclosure Integrity.
  - 4. C57.12.29-99 Switchgear and Transformers – Pad-Mounted Equipment – Enclosure Integrity for Coastal Environments.
- D. American Society for Testing and Materials (ASTM):
  - 1. D3487-00 Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus.
- E. Institute of Electrical and Electronic Engineers (IEEE):
  - 1. 48-96 Standard Test Procedures and Requirements for Alternating Current Cable Terminations 2.5kV Through 765kV.
  - 2. 386-95 Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V (ANSI/IEEE).
  - 3. 592-90 Standard for Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors.
- F. National Electrical Manufacturers Association (NEMA):
  - 1. C57.12.26-93 Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34500 Grd Y/19920 Volts and Below; 2500 kVA and Smaller TR1-93 Transformers, Regulators, and Reactors.
- G. National Fire Protection Association (NFPA):
  - 1. 70-02 California Electrical Code (CEC).
- H. Underwriters Laboratories Inc. (UL):
  - 1. 467-93 UL Standard for Safety Grounding and Bonding Equipment.

## PART 2 - PRODUCTS

## 2.1 EQUIPMENT, GENERAL

- A. Equipment shall be in accordance with ANSI, ASTM, IEEE, NEMA, NFPA, UL, as shown on the drawings and as hereinafter specified.
- B. Ratings shall not be less than shown on the drawings.
- C. Provide units designed to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses that may occur during operation.
- D. Completely fabricate units at the factory so that only the external cable connections are required at the job site.
- E. Thoroughly clean, phosphatize and finish all the metal surfaces at the factory with a rust-resistant primer and dark green enamel finish coat, except where a different color is specified in Paint Section, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE. All surfaces of the unit that will be in contact with the concrete pad shall be treated with corrosion-resistant compounds and epoxy resin, or a rubberized sealing compound.

## 2.2 COMPARTMENTS

- A. Construction:
  - 1. The high and low voltage compartments and the transformer compartment shall be fabricated by a single manufacturer. The compartments and the transformer tank shall be assembled as an integral unit by a single manufacturer. Enclosures shall be in accordance with ANSI C57.12.28 or ANSI C57.12.29 if installed in coastal environments.
  - 2. The high and low voltage compartments shall be separated with a steel barrier.
  - 3. The compartments shall be constructed of sheet steel (gage to meet ANSI requirements) with bracing, reinforcing gussets and jig-welding to assure rectangular rigidity.
  - 4. Use cadmium or zinc plated bolts, nuts and washers.
  - 5. Sufficient space shall be provided for equipment, cabling and terminations in the compartments.
  - 6. Affix the transformer instruction nameplate permanently to the unit within the low voltage compartment. Voltage ratings, kVA rating, connection configuration, impedance, date of manufacture and serial number shall be shown on the nameplate.
- B. Doors:
  - 1. Provide a separate door for each compartment with provision for a single padlock to secure the compartment area. The high voltage compartment door shall be prevented mechanically from opening, unless the low voltage door is opened and penta head bolt is removed.
  - 2. The secondary compartment door shall have a one-piece steel handle and incorporate three-point locking mechanisms to assure a secure and tight door closing. Provide each compartment door with open-position doorstops and tamperproof hinges. The hinge assembly shall be made of corrosion-resistant material welded in place.

### 2.3 BIL RATING

- A. 25 kV class equipment shall have a minimum 125 kV BIL rating.

### 2.4 DEAD FRONT CONSTRUCTION

- A. No exposed live parts, including the cable terminations, shall be accessible within the high voltage compartment.
- B. Make connection to the high voltage switch(es) through 200 ampere externally clamped universal bushing wells mounted within the transformer tank and bushing inserts. Provide a parking stand for each cable that terminates within the high voltage compartment.

### 2.5 HIGH VOLTAGE PREFORMED TERMINATIONS

- A. Terminate the high voltage cables in the high voltage compartment with load break premolded rubber elbow connectors. Elbow connectors shall have a minimum of 0.125 inch semi-conductive shield material covering the housing. Each connector shall be tested - prior to shipment from the factory.
- B. Ground metallic cable shields with a device designed for the purpose. It shall consist of a solderless connector enclosed in watertight rubber housing covering the entire assembly. The grounding device and elbow connector are to be of the same manufacturer to insure electrical integrity of shielded parts.
- C. Premolded parts shall be suitable for submersible applications.
- D. Elbow connectors shall be rated as follows:
  - 1. Voltage: 21 kV phase-to-phase.
  - 2. BIL: 125 kV.
  - 3. AC withstand: 34 kV, 60 Hz for 1 minute.
  - 4. DC withstand: 65 kV (field test rating).
  - 5. Corona voltage: 11 kV minimum.
  - 6. Continuous current: 200 amperes RMS.
  - 7. Short time current: 10,000 amperes for 12 cycles.
  - 8. Fault closure: 10,000 amperes RMS symmetrical for 10 cycles (after 10 loadmake/loadbreak operations at 200 amperes and 21 kV contact voltage).
- E. Interchangeability: The separable connector system shall include the loadbreak elbow, the bushing insert, and bushing well. Separable connectors shall comply with the requirements of IEEE 386, and shall be interchangeable between suppliers. Loadbreak elbow and bushing insert shall be from the same manufacturer.
- F. Allow sufficient slack in high voltage cable, ground, and drain wires to permit elbow connectors to be moved to their respective parking stands.
- G. Provide insulated cable supports to relieve any strain imposed by cable weight or movement.

## 2.6 LOW VOLTAGE EQUIPMENT

- A. Where applicable, mount the transformer secondary main molded case circuit breaker, panelboard, low voltage bushings, and hot stick in the low voltage compartment. Mount the main breaker off of the transformer tank to allow sufficient ventilation and assure that the heat from the transformer tank will not be transmitted through conduction. Circuit breakers shall be of the ambient compensating type, and have interrupting ratings for the available fault current.
- B. Tin plate the low voltage neutral terminal and isolate from the transformer tank. Provide a removable ground strap sized in accordance with the CEC and connect between the neutral and ground pad.

## 2.7 TRANSFORMERS

- A. Transformers shall be three-phase and single-phase, liquid-immersed, isolated winding, and self cooled by natural convection.
- B. The kVA ratings shown on the drawings are for continuous duty without the use of cooling fans.
- C. Temperature rises shall not exceed the NEMA TR1 standards of 65 degrees C by resistance, and 150 degrees C hot spot at rated kVA.
- D. Transformer insulating material shall be vegetable Type FR3 oil and shall be in accordance with ASTM.
- E. Transformer impedance shall be not less than 4.5 percent for sizes 150 kVA and larger.
- F. Sound levels shall conform to NEMA TR1 standards.
- G. Primary and Secondary Windings for Three-phase Transformers:
  - 1. Primary windings shall be delta connected.
  - 2. Secondary windings shall be wye connected, except where otherwise indicated on the drawings. Provide isolated neutral bushings for secondary wye connected transformers.
  - 3. Secondary leads shall be brought out through pressure-tight epoxy bushings.
- H. Primary windings shall have four 2-1/2 percent full capacity voltage taps; two taps above and two taps below rated voltage.
- I. Core and Coil Assemblies:
  - 1. Cores shall be grain-oriented, non-aging, silicon steel to minimize losses.
  - 2. Core and coil assemblies shall be rigidly braced to withstand the stresses caused by rough handling during shipment, and stresses caused by any possible short circuit currents.
  - 3. Coils shall be continuous winding type without splices except for taps.
  - 4. Coil and core losses shall be optimum for the most efficient operation.
  - 5. Primary, secondary and tap connections shall be brazed or pressure type.
  - 6. Provide end fillers or tie downs for coil windings.
- J. The transformer tank, cover, and radiator gage thickness shall not be less than that outlined in ANSI.



## K. Accessories:

1. Provide standard NEMA features, accessories, and the following:
  - a. No-load tap changer (Provide warning sign).
  - b. Lifting, pulling and jacking facilities.
  - c. Globe-type valve for oil filtering and draining, including sampling device.
  - d. Pressure relief valve.
  - e. Liquid level gage and filling plug.
  - f. A grounding pad in the high and low voltage compartments.
  - g. A diagrammatic nameplate and operating instructions enclosed by a transparent cover located in the low voltage compartment.
  - h. Dial type liquid thermometer with a maximum reading pointer and an external reset.
  - i. Hot stick. Securely fasten hot stick within low voltage compartment.
2. The accessories shall be made accessible within the compartments without disassembling trims and covers.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install the equipment in accordance with the CEC, as shown on the drawings, and as recommended by the equipment manufacturer.
- B. Foundations:
  1. Provide foundations of reinforced concrete, Type C, 3000 psi minimum, 28 day compressive strength, and comply with the ACI 318.
  2. Locate the top of foundation pads 6" above the adjacent finished grade, unless otherwise shown on the drawings. Refer to drawings for size, location, and structural steel reinforcing required.
  3. Grade the adjacent terrain so that surface water will flow away from the foundation.
  4. Anchor the transformers with cadmium or zinc plated bolts, nuts and washers. Bolts shall not be less than 1/2" diameter.
- C. Grounding
  1. Ground each padmounted transformer in accordance with the requirements of the CEC. Install 3/4" diameter by 10' long copper-clad ground rods, driven 10' below grade to maintain a maximum resistance of five ohms to ground. Thermite weld the cable to the ground rods.
  2. Connect the ground rod to the ground pads in the high and low voltage compartments, and to the secondary (and primary) neutral with not less than a 2/0 AWG bare copper conductor.
  3. Refer to the section of the specifications describing GROUNDING for testing.
  4. Independently connect cable shield grounding devices ground wires to ground with sufficient slack to permit elbow connector operation. Connect elbow connectors with a No. 14 AWG bare copper drain wire from its grounding eye to the related cable shield grounding device ground wire. Do not connect drain wires in any manner that will permit circulating currents, or cable fault currents, to pass through them.
  5. Pad mounted equipment shall be sealed with caulking between bottom of metal housing and the concrete pad or slab to prevent entrance of dust and debris.

### 3.2 SPARE PARTS

- A. Deliver the following spare parts for the project to the Owner two weeks prior to final inspection:
  - 1. Six stand-off insulators.
  - 2. Six insulated protective caps.
  - 3. One spare set of high voltage fuses for each size fuse used in the project.

### 3.3 INSTRUCTIONS

- A. The contractor shall instruct School District maintenance personnel, for not less than a 2-hour period, on the maintenance and operation of the equipment on the date requested by the IOR.

END OF SECTION

## SECTION 26 22 00 – LOW VOLTAGE TRANSFORMERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Dry type general purpose transformers rated 600 volts and below.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
  - 3. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include electrical rating, impedance, dimensions, weight, mounting details and materials, decibel rating, terminations, temperature rise, no load and full load losses, and connection diagrams.
  - 3. Complete nameplate data including manufacturer's name and catalog number.
- C. Manuals:
  - 1. Submit, simultaneously with the shop drawings, companion copies of complete operating and maintenance manuals including technical data sheets and wiring diagrams.

## 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Fire Protection Association (NFPA):

1. 70-2010 California Electrical Code (CEC)
- C. National Electrical Manufacturers Association (NEMA):
  1. ST 20-1992 Dry-Type Transformers for General Applications
  2. DOE-2016 Energy Efficient Transformers

## PART 2 - PRODUCTS

### 2.1 GENERAL PURPOSE DRY TYPE TRANSFORMERS

- A. Unless otherwise specified, dry type transformers shall be in accordance with NEMA, CEC and as shown on the drawings. Transformers shall be UL listed or labeled. All transformers shall comply with NEMA TP-1 energy efficiency standards as adopted by the State of California. Efficiency shall be tested in accordance with NEMA TP2.
- B. Dry type transformers shall have the following features:
  1. Self-cooled by natural convection, isolating windings, indoor, dry type. Autotransformers shall not be accepted unless otherwise stated.
  2. Rating and winding connections shall be as shown on the drawings.
  3. Ratings shown on the drawings are for continuous-duty without the use of cooling fans.
  4. Insulation systems:
    - a. Transformers 30 KVA and larger: UL rated 220 degree C system having an average maximum rise by resistance of 115 degree C in a maximum ambient of 40 degree C.
    - b. Transformers below 30 KVA: Same as for 30 KVA and larger or UL rated 185 degree C system having an average maximum rise by resistance of 115 degree C in a maximum ambient of 40 degree C.
  5. Core and coil assemblies:
    - a. Rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment.
    - b. Cores shall be grain oriented, non-aging, silicon steel.
    - c. Coils shall be continuous windings without splices except for taps.
    - d. Coil loss and core loss shall be optimum for efficient operation. NEMA TP-1 type.
    - e. Primary and secondary tap connections shall be brazed or pressure type.
    - f. Coil windings shall have end fillers or tie downs for maximum strength.
    - g. Terminals shall be rated 75 degrees C minimum.

6. Certified sound levels determined in accordance with NEMA, that do not exceed the following:

Transformer Rating	Sound Level Rating
0 - 9 KVA	40 dB
10 - 50 KVA	45 dB
51 - 150 KVA	50 dB

7. Nominal impedance shall be as permitted by NEMA.
8. Single phase transformers rated 15 KVA through 25 KVA shall have two, 5 percent full capacity taps below normal rated primary voltage. All transformers rated 30 KVA and larger shall have two, 2-1/2 percent full capacity taps above, and four, 2-1/2 percent full capacity taps below normal rated primary voltage.
9. Core assemblies shall be grounded to their enclosures by adequate flexible ground straps.
10. Enclosures:
- Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
  - Ventilation openings shall prevent accidental access to live components.
  - Thoroughly clean and paint at the factory with manufacturer's prime coat and standard finish.
11. Standard NEMA features and accessories including ground pad, lifting provisions and nameplate with the wiring diagram and sound level indicated on it.
12. Dimensions and configurations shall conform to the spaces designated for their installations.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- Installation shall be in accordance with the CEC, and as shown on the drawings.
- Install the transformers with adequate clearance at a minimum 6 inches or more from wall and adjacent equipment for air circulation to remove the heat produced by transformers and as recommended by the manufacturer to achieve U.L. listing.
- Install transformers on vibration pads designed to suppress transformer noise and vibrations.
- Use liquidtight flexible metal conduit to contain the conductors from the transformer to the raceway system.
- Transformers shall be secured to meet CBC seismic zone 4 requirements.

END OF SECTION

## SECTION 26 24 14 - DISTRIBUTION SWITCHBOARDS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Service and distribution switchboard where shown on the contract drawings and specified herein.

## 1.3 QUALITY ASSURANCE

- A. Conform to applicable Codes and NEMA, ANSI and IEEE Standards.

## 1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings shall show and contain the following information:
  - 1. Plans showing top and bottom of switchboards.
  - 2. Front, rear and side elevations of switchboards.
  - 3. Schematic Wiring Diagrams showing the following:
    - a. One-line diagram with each circuit numbered.
    - b. Schedule showing circuit number, description and rating of protective device(s).
    - c. Complete short circuit with standability of bus.
  - 4. 1/2" - 1'-0" scale drawings of electrical rooms or areas overall dimensions for equipment layout including space available for conduits and protective devices.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Each switchboard shall be U.L. listed deadfront, deadrear, completely self-supporting, with the required number of vertical sections bolted together to form one floorstanding switchboard. Construction shall be NEMA Class II with line and load and main bus connections accessible from the front. Provide switchboards of 1000 amperes or greater rating with line and load insulated bus bars. Overcurrent protective devices shall be grouped in convertible type construction. Vertical sections shall have full height bussing and where space for future devices

is indicated on the Drawings all the necessary mounting hardware shall be furnished. Switchboards shall include all protective devices and other equipment indicated on the Contract Drawings with the necessary interconnections, instrumentation, and control wiring. Bus shall be copper with plated joints, or tin plated aluminum. Bus bars shall be mounted on supports of high impact-resistant, non-tracking insulating material, and braced to withstand the maximum available fault current as indicated on the Contract Drawings. Other ratings shall be as indicated on the Contract Drawings. Series-connected or "integrated equipment" short circuit ratings shall not be applied in lieu of, or to comply with, short circuit and interrupting capacity ratings indicated on the Drawings, unless specifically approved by the Engineer.

- B. Service and distribution sections shall contain circuit breakers, fusible switches, and combination motor starters, with shunt trips, motor operators, ground fault protection, and other accessories, as indicated on the Drawings, as well as provisions for utility metering in accordance with the serving electric utility requirements. Each disconnecting means shall be provided with a means for individual padlocking. Switches shall be heavy-duty, quick-make and quick-break, and horsepower rated through 500 HP. Switches rated over 600 amperes shall be bolted pressure contact type. Ratings of disconnecting means and overcurrent protective devices shall be as indicated on the Drawings.
- C. Finish: Interior finish shall be a gray lacquer or enamel; exterior finish shall be a gray baked-on enamel or lacquer. Apply all finish coatings over a rust-inhibiting metal primer.
- D. Identification: Each switchboard shall have an engraved laminated plastic nameplate identifying the switchboard as designated and located on the Contract Drawings, and indicating voltage, phase, and number of system conductors. For example, "Switchboard MS 277/480V. 3Ø 4W. Lettering shall be white on black finish and 2" high minimum. Nameplates shall be affixed by a minimum of two escutcheon pins or screws. Each device on the switchboard shall be provided with an engraved plastic nameplate as specified in Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION

- A. Switchboard(s) shall be securely bolted to the flooring or structure. Final attachment means shall be in compliance with the seismic requirements of governing authority. Shop Drawings indicating the bolt down requirements shall be provided by the manufacturer along with all necessary calculations and shall be submitted with the Shop Drawings of the switchboard equipment. Refer to other Sections of the Specifications related to seismic requirements.
- B. Switchboard(s) shall be installed on a level floor, with shims provided where necessary to attain both horizontal and vertical "plumb" conditions.
- C. Switchboard(s) equipment shall be protected during construction in such a manner to prevent plaster, paint, dust, etc. from defacing the finish of equipment. Prior to final acceptance of the equipment, the interior of the equipment shall be cleaned of all foreign materials and debris. Any blemishes or defects on the exterior of the equipment shall be repaired by painting the equipment with paint supplied by the manufacturer of the equipment to match the factory finishes.

- D. All floor mounted switchgear and panelboards shall be sealed with caulking between bottom of metal housing and the concrete pad or slab to prevent entrance of dust and debris.
- E. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.
- F. All ventilated openings in panelboards and switchboards shall be furnished with dust filters to prevent entrance of dust and debris.
- G. No operating handles in any switchboard shall be located above 6' - 6" above finish floor. Code clearances on all sides of the switchboard equipment shall be maintained.
- H. Switchboards shall be mechanically grounded to the grounding system.
- I. Furnish ammeters, voltmeters, current and potential transformers, test blocks, control switches, fuses and circuit breakers, and other devices as indicated on the Drawings.
- J. For solidly grounded "wye" services of more than 150 volts to ground, but not exceeding 600 volts phase to phase, provide ground fault protection of equipment for each service disconnecting means for services rated 1000 amperes or more, without a single main disconnecting means. Provide ground fault protection of equipment for other systems as indicated on the Drawings.
- K. Ground fault sensors shall be zero sequence type unless indicated otherwise on the Drawings. Trip settings shall be as indicated on the Drawings or as directed by the Engineer.
- L. Protection: Keep switchboards covered during construction operations. Clean interior and exterior after all connections are completed. Factory connections shall be checked and re-torqued tight as required. Damage shall be field or factory repaired to a condition acceptable to the Engineer at no added cost to the City.
- M. Operational Test of the ground fault protection system using the primary current injection method shall be performed by qualified personnel with suitable testing/recording equipment in the presence of the Engineer. Provide the Engineer with a "Certified Test Report" including test parameters.

### 3.2 ACCEPTANCE TESTING OF SWITCHGEAR AND SWITCHBOARD ASSEMBLIES

- A. General:
  - 1. Inspect for physical damage.
  - 2. Compare equipment nameplate information with latest single line diagram and report discrepancies.
  - 3. Inspect for proper alignment, anchorage and grounding.
  - 4. Check tightness of accessible bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instruction for proper foot pound levels.
  - 5. Key interlock systems shall be physically tested to insure proper function.
    - a. Closure attempt shall be made on locked open devices. Opening attempt shall be made on locked closed devices.
    - b. Key exchange shall be made with devices operated in off-normal positions.



6. All doors, panels and sections shall be inspected for paint, dents, scratches.
7. Furnish the services and provide report from an independent testing agency for the testing of all GFP circuit breakers.

END OF SECTION

## SECTION 26 24 16 – PANELBOARDS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Panelboards.
- B. Related Work:
  - 1. Division 09 “PAINTING”: Identification and painting of panelboards.
  - 2. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 3. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 4. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
  - 5. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

## 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
  - 1. No. 50 Enclosures for Electrical Equipment
  - 2. No. 67 Panelboards
  - 3. No. 489 Molded Case Circuit Breakers and Circuit Breaker enclosures
- C. National Fire Protection Association (NFPA):
  - 1. No. 70-2022 California Electrical Code (CEC)
- D. National Electrical Manufacturers Association (NEMA):
  - 1. No. PB-1 Panelboards.
  - 2. No. AB-3 Molded Case Circuit Breakers and Their Application.

## PART 2 - PRODUCTS

## 2.1 PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, CEC and as shown on the drawings. Approved manufacturers are Eaton, Square D, ABB/General Electric.
- B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.
- D. All panelboards shall be completely factory assembled with molded case circuit breakers. All factory wiring shall be checked for correct tightness and visually inspected to insure that bussing and terminations have not become loose in transit to job site.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings. Refer to single line diagram and panel schedules on drawings. Terminals shall be minimum 75 degree rated. Back fed main circuit breakers are not allowed. Main circuit breakers shall be vertically mounted.
- F. Panelboards shall have the following features:
  - 1. Nonreduced size copper bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
  - 2. Full size neutral bar, mounted on insulated supports.
  - 3. Ground bar and isolation ground bar (where called for in panel schedule) with sufficient terminals for all grounding wires. Buses braced for the available short circuit current.
  - 4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps. Where used for heating and air conditioning, and refrigeration equipment, use only HACR type U.L. listed circuit breakers.
  - 5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping.
  - 6. Where designated on panel schedule as "space", include all necessary bussing, device support and connections. Provide blank cover for each space.
  - 7. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.
  - 8. Series rated panelboards are not permitted.
  - 9. Label all panels in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
  - 10. Recessed panel space conduit: Provide (1)  $\frac{3}{4}$  inch spare conduit stubbed to accessible ceiling space and/or interstitial space below floor for every (5) spaces and spares indicated on panel schedules.

- G. Panelboards serving as building mains shall be "service entrance rated" and UL Listed as "service equipment".

## 2.2 CABINETS AND TRIMS

### A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
2. All ventilated openings in panelboards and switchboards, shall be furnished with dust filters to prevent entrance of dust and debris.
3. Cabinets for panelboards may be of one piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide necessary hardware for "in" and "out" adjustment of panel interior.
5. Cabinets for two section panelboards shall be arranged side by side, and shall be the same height. Flush mounted cabinets should be 1 1/2" apart and coupled by conduit nipple if necessary.
6. Gutter size in panel boxes, on all sides, shall be in accordance with the CEC. Penetrations through gutter to live area of the panelboard shall incorporate approved non-metallic-grommet type of insulation to protect wire passing through.

### B. Trims:

1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
2. Flush trims shall overlap the box by at least 3/4" all around.
3. Surface trim shall have the same width and height as the box.
4. Flush or surface trims shall not have ventilating openings.
5. Secure trims to back boxes by indicating trim clamps.
6. Provide a welded angle on rear of trim to support and align trim to cabinet.
7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.

### C. Doors:

1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three-point catch, arranged to fasten door at top, bottom, and center.
2. In making switching devices accessible, doors shall not uncover any live parts.
3. Provide concealed hinges welded to the doors and trims.
4. For lighting or power contactors incorporated in panelboards, provide separate doors for the contactors.
5. Provide keyed alike system for all panelboards.
6. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

### D. Painting:

1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

## 2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

- A. Breakers shall be UL listed and labeled, in accordance with the CEC, as shown on the drawings, and as specified.
- B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.
  - 1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated.
  - 2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3 times to 10 times for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.
- C. Breaker features shall be as follows:
  - 1. Integral housing of molded insulating material.
  - 2. Silver alloy contacts.
  - 3. Arc quenchers and phase barriers for each pole.
  - 4. Quick-make, quick-break, operating mechanisms.
  - 5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
  - 6. Electrically and mechanically trip free.
  - 7. An operating handle which indicates ON, TRIPPED, and OFF positions.
    - a. Line connections shall be bolted.
    - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings. The interrupting rating shall not be less than the minimum identified requirement.
  - 8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

## 2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Installation shall be in accordance with CEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes and layout of cabinets within the designated spaces. All equipment must

be dimensioned in order to physically fit in the spaces provided and to comply with all code required clearances.

- C. Install a typewritten schedule of circuits in each panelboard. Include the room numbers (as finally described by the Owner) and items served on the cards. Obtain final room numbers from Architect prior to creating schedule.
- D. Mount the panelboard so that maximum height of the top circuit breaker above finished floor shall not exceed 78 inches.
- E. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.
- F. Circuit numbers shall correspond to the approved panel schedule. Provide as-built drawings showing the actual circuit numbers being used for each device on each branch circuit if changes are required.
- G. Verify depth of all flush mounted enclosures in walls to be certain wall depth will accommodate panel depth prior to installation.
- H. All openings in switchgear and panelboards that are unused shall be sealed with bolts and washers. Use caulking where holes or openings cannot be sealed by way of a washer, or bolts or conduit seals.
- I. Contractor shall include the services of an independent testing company to test GFI circuit breakers in distribution and main panelboards.

END OF SECTION

## SECTION 26 27 26 - WIRING DEVICES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Wiring devices.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
  - 4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

## PART 2 - PRODUCTS

## 2.1 RECEPTACLES

- A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
  - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
  - 2. Receptacles shall be of a screw terminal type, "pressure type quick wire" terminations are not allowed.
  - 3. 15 ampere and 20 ampere, 125-volt and 250-volt non-locking receptacles shall be tamper resistant type receptacles unless the application is specifically listed as an exception to CEC 406.12.
  - 4. Receptacles shall be "wet rated" when used in an exterior location.
- B. Duplex receptacles shall be premium specification grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex

type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Bodies shall be white in color. Contractor to verify device color with Architect prior to procurement.
  2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
  3. Controlled receptacles; installed per requirements of 2022 BUILDING ENERGY EFFICIENCY STANDARDS / Efficiency Standards, California Code of Regulations, Title 24, Part 6. SECTION 130.5 (d) – ELECTRICAL POWER DISTRIBUTION SYSTEMS as Circuit Controls for 120-Volt Receptacles and / or Controlled Receptacles. Shall be provided with an approved means of including a permanent and durable marking identifying the controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits. Where shown on associated floor plans, and or required by the Standards; a duplex noted to be controlled shall be 'split-wire', so the top outlet shall be switched and the bottom outlet shall be unswitched. A double duplex (fourplex) noted to be controlled: one of the duplex receptacles shall be controlled and the other duplex receptacle shall be unswitched.
  4. Duplex Receptacles on Emergency Circuit: Receptacle bodies shall be red in color. Wall plates shall also be powder coat painted red finish. Cover shall be labeled with panel and circuit number.
  5. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
    - a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.
- C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.
- D. Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. Approved manufacturers: Intermatic WP10 Series, Thomas & Betts/Red Dot 2CK Series, or engineer approved equal.

## 2.2 SWITCHES AND DIMMERS

- A. Style Line/Decora rocker switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and be of a screw terminal type.
  2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
  3. Ratings:
    - a. 120 volt circuits: 20 amperes at 120-277 volts AC.



- b. 277 volt circuits: 20 amperes at 277 volts AC.
- 4. The switches shall be mounted on the strike plate side of doors.
- 5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
- 6. All toggle switches shall be of the same manufacturer.
- B. Dimmers: Wall-mounted dimmers shall be specification grade with capability of raising and lowering the lighting from completely off to full intensity. Dimmers shall maintain full load rating even when two or more units are installed adjacent to one another. All wall-mounted dimmers shall be of the same manufacturer and of a "slide" type. Color shall match all other wiring devices on project.

## 2.3 WALL PLATES

- A. Wall plates for switches and receptacles shall be type 302 stainless steel.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.
- D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.
- F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Switches installed in hazardous areas shall be explosion proof type in accordance with the CEC and as shown on the drawings.
- B. Installation shall be in accordance with the CEC, NECA "Standard of Installation", and as shown as on the drawings.
- C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.
- D. General: Devices shall be of the type specified herein. All devices shall be installed with "pigtailed" leads from the outlet box. No device shall be used in the "feed through" application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.

- E. Installation: Devices and plates shall be installed in a “plumb” condition and must be flush with the finish surface of the wall where boxes are recessed.
- F. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.
- G. Install switches with the off position down.
- H. Clean debris from outlet boxes.
- I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.
- J. Test each receptacle device for proper polarity.

END OF SECTION

## SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Disconnect and safety switches where shown on the contract drawings and specified herein.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Related Work:
  - 1. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.

## PART 2 - PRODUCTS

## 2.1 GENERAL

- A. Approved Manufacturers: Cutler Hammer, General Electric, ITE-Siemens and Square-D.
- B. Disconnect Switches: Provide with devices enabling the switch to be locked in the open or closed positions.
- C. Manual Motor Switches: Tumbler type rated 3HP, 240 Volts with or without overload heaters as required to protect equipment served.
- D. Externally Operable Safety Switches: To have quick-make, quick-break mechanism, capable of switching 10 times switch rating, with cover interlock to prevent opening with switch in ON position and defeat mechanism for maintenance.
- E. Switches: Shall be general duty (GD) for 240 volt and below and heavy duty (HD) for 277/480 volt type unless otherwise indicated. Provide NEMA 1 enclosures for interior locations and NEMA 3R enclosures for exterior or wet locations. Provide with number of poles, ampacity, voltage and HP rating, fusible or nonfusible as indicated. Copper blades shall be visible in off position.

- F. Fusible Switches: Equip them with rejection clips for UL Class R fuses. Switches having a dual rating when used with dual element fuses shall have a rating so indicated and shall be confirmed by equipment vendor being connected.
- G. 600 Amperes or Less Fuses: UL Class RKI with a minimum interrupting rating of 200,000 Amperes, Bussmann "Low-Peak Type" or equal.

### PART 3 - EXECUTION

#### 3.1 GENERAL INSTALLATION

- A. Locations: Install switches, disconnects and safety where indicated on the Contract Drawings or as required by CEC.
- B. Fastenings: Securely fasten switches to structural members or unistrut support as directed by the manufacturer.
- C. Manual Motor Switches: Install flush mounted in finished areas.
- D. Manual Motor Switches: Install surface mounted in equipment rooms and non-finished areas. Where installed above inaccessible ceilings provide access panels.
- E. Label all disconnect switches in accordance with Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- F. Fuse: All fuses shall be as indicated on the plan or as required by the equipment. Verify fuse size with equipment manufacturer requirements, prior to installation. Use current limiting fuses as indicated on plan. Provide one spare fuse cabinet in each electrical room with one complete set of spare fuses for all sizes of main fuses, subpanel fuses, HVAC equipment fuses and fire alarm.
- G. Terminals shall be minimum 75 degree rated.

### END OF SECTION

## SECTION 26 31 00 - PHOTOVOLTAIC SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Contractor provided PV Array Racking System Shop Drawing submittal.

## 1.2 SUMMARY

- A. This Section:
  - 1. Specifies the furnishing/procurement, installation, connection, testing, and commissioning of solar energy electrical power generation systems.
  - 2. Applies to all sections of Division 48 related to solar energy electrical power generation systems.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
  - 3. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
  - 4. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 5. Section 26 05 53, IDENTIFICATION OF ELECTRICAL SYSTEMS.
  - 6. Section 26 24 16, PANELBOARDS.
  - 7. Section 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS: Requirements for enclosed disconnect switches.

## 1.3 DEFINITIONS

- A. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE 100 CD.
- B. Unless otherwise specified or indicated, solar energy conversion terms used in these specifications, and on the drawings, are as defined in ASTM E772.

## 1.4 SYSTEM DESCRIPTION

- A. Provide materials, labor, equipment, installation, testing, services and incidentals necessary to install a complete solar PV system feeding AC power to the utility grid in accordance with IEEE 1547 and local utility regulations, and as shown on the approved drawings. The PV

system must comply with these specifications, all applicable codes and standards, all construction documents, and all local AHJ's.

- B. Provide all necessary components and accessories for a complete, secure, and operational solar PV system, including:
  - 1. PV modules (framed)
  - 2. Inverters
  - 3. Overcurrent protection/combiner boxes (as applicable)
  - 4. DC and AC balance of systems, including raceways, boxes, gutters, enclosures, grounding, quick-connect electrical connectors, DC wiring and disconnects, AC wiring and disconnects and AC panelboard/switchboards (as applicable)
  - 5. Mounting/racking system and associated hardware, including structural supports system.
  - 6. Monitoring and Data Acquisition Systems (DAS)

## 1.5 SUBMITTALS AND SHOP DRAWINGS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Submit detailed information for components of the solar electrical generation system, including for those mentioned in Part 1.4.B. of this specification. This detailed information shall include rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, and manufacturer warranty information.
- C. Submit construction and shop drawings with sufficient information to demonstrate compliance with bridging documents and specifications. Include electrical ratings/capacities, dimensions, mounting details, installation and assembly details, materials, required clearances, terminations, weight, wiring and connection diagrams, accessories, and nameplate data. Include shop drawings for foundations and other support structures.
- D. Submit a comprehensive Operation and Maintenance (O&M) manual for each system. Further information on the required contents of this manual as well as its format and organization can be found in Part 3.4.B of this specification.
  - 1. If changes have been made to the O&M manual originally submitted, then submit updated maintenance and operating manuals two weeks prior to the final inspection.
- E. Submit certifications two weeks prior to final inspection, including the following:
  - 1. Certification by the manufacturers of all major items of the solar energy electric generation system that the system conforms to the requirements of the drawings and specifications, and that they have jointly coordinated and properly integrated their equipment and controls to provide a complete and functional installation.
  - 2. Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warrantied. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.
- F. Submit copies of all applications and documentation provided to the serving utility related to interconnection and net metering required per CPUC Electric Rule 21. In all cases, the serving electric utility may have a requirement for further electrical studies, which may include (but are not limited to) power factor analysis, short circuit protection studies, grid wiring adequacy, or

capacities of upstream equipment. If such requirements exist and are required by the serving electric utility and substantially increase interconnection costs or the ability to interconnect the project, the Contractor shall promptly notify the Owner and seek approval from Owner before making any changes to the interconnect application. These additional utility requirements shall be fulfilled by the Contractor at the Owner's expense.

- G. Provide written documentation confirming the utility's approval of the interconnection of the solar energy electrical power generation system with the utility system. The Contractor shall be responsible for all interconnection coordination, including review of any previous interconnect applications, utility company coordination, revisions to interconnect applications as-needed, inspections, and final approval for the complete interconnection of the PV systems with the utility company grid, including bi-directional utility meters at each location. The Contractor shall ensure that the design and construction does not void any tariff grandfathering achieved by the initial interconnect applications submitted with the utility.

## 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Underwriters Laboratories, Inc. (UL):
  - 1. UL 467 - Standard for Safety Grounding and Bonding Equipment
  - 2. UL 1703 – Standard for Flat-Plate Photovoltaic Modules and Panels
  - 3. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
  - 4. UL 2703 – Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for use with Flat-Plate Photovoltaic Modules.
- C. Institute of Electrical and Electronics Engineers (IEEE)
  - 1. No. 929-2000 - Recommended Practice for Utility Interface of Photovoltaic (PV) Systems
  - 2. No. 1547-2018 - Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
  - 3. IEEE Standards Dictionary: Glossary of Terms & Definitions (2009)
- D. International Electrotechnical Commission (IEC)
  - 1. No. 62446-1 - Photovoltaic (PV) Systems - Requirements for Testing, Documentation and Maintenance - Part 1: Grid Connected Systems - Documentation, Commissioning Tests and Inspection
- E. ASTM International (ASTM)
  - 1. No. E772-15 - Standard Terminology of Solar Energy Conversion
  - 2. No. E2848-13 - Standard Test Method for Reporting Photovoltaic Non-Concentrator System Performance
  - 3. No. E3010-15 - Standard Practice for Installation, Commissioning, Operation, and Maintenance Process (ICOMP) of Photovoltaic Arrays
- F. American National Standards Institute (ANSI)
  - 1. No. C12.1-16 - Electric Meters - Code for Electricity Metering

- G. National Fire Protection Association (NFPA):
  - 1. No. 70-2022 California Electrical Code (CEC), with State of California Amendments
- H. National Electrical Manufacturers Association (NEMA):
  - 1. No. 250-14 - Enclosures for Electrical Equipment (1,000 Volts Maximum)
- I. California Building Code (CBC), with State of California Amendments
- J. California Energy Commission Title 24 Building Energy Efficiency Requirements
- K. California Department of Forestry and Fire Protection, Office of the State Fire Marshal – Solar Photovoltaic Installation Guidelines
- L. Local utility solar program guidelines, including net energy metering interconnection requirements, as applicable.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Storage of equipment for the job is the responsibility of the Contractor and shall be scheduled for delivery to the site, as the equipment is required. All materials shall be delivered new, undamaged and without defects. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Contractor.
- B. All components shall be new and direct from the respective manufacturer; used or refurbished materials are not permitted.
- C. Store solar PV modules in the original packaging according to the manufacturer's guidance and are to remain in packaging until the day of installation. If a solar PV module is removed from its packaging, store according to the manufacturer's guidance.
- D. All equipment and panels shall be handled with care so as not to damage the delivered products. All equipment shall be installed in new and neat condition.
- E. Appropriate protective clothing shall be worn when handling the equipment.
- F. Where PV systems will be installed on a roof or overhead, all materials stored on the roof shall be distributed so as not to overload the roof at any point. All materials stored on roof shall follow the guidelines of the roofing system manufacturer including protection boards, pallets and/or mats to prevent damage to the roof system and insulation assemblies. All roof top construction, construction related traffic and staging areas shall have protection boards in place to prevent damage to the roofing system and insulation assemblies.

#### 1.8 GUARENTEES

- A. Materials and equipment shall be listed by an independent testing laboratory for the class of service intended (Underwriters Laboratories or equivalent).
- B. Damaged equipment shall be repaired or replaced as necessary at no cost to the owner prior to final acceptance.



- C. Guarantees shall be submitted to the owner, in writing, prior to final acceptance.
- D. The installation, including labor, shall be warranted free of defects for a minimum of one year from date of owner final acceptance. Any defect related to the contractor's work, during the warrantee period, shall be corrected at the contractor's expense.
- E. Equipment shall be warranted free of defects for a minimum of one year or as stated in this specification, whichever is a longer duration.
  - 1. PV Module Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable system manufacturers/vendors shall be as specified on the associated electrical drawings of the Contract construction documents. Manufacturers shall provide their latest line of equipment, meeting all current industry standards, utility requirements and criteria set forth in the Contract. The Owner seeks equipment from proven, industry leading manufacturers in solid financial standing, producing "tier-one" financeable equipment.
- B. Contractor proprietary products shall have an ICC report or a testing report stamped and signed by a licensed California engineer.

### 2.2 EQUIPMENT AND MATERIALS

- A. PV modules shall meet the following:
  - 1. Solar PV module manufacturer, model, and number of modules must match the approved plans or substitutions may be allowed upon approval by the EOR.
  - 2. Module manufacturer that has produced no less than 250MW of modules in the prior year.
  - 3. Modules are from a field-tested product line that has been commercially available for no less than three years.
  - 4. Module manufacturer shall provide a 25-year warranty on the solar modules with at least 80 percent power output guaranteed at 25 years. The solar module manufacturer shall confirm that the warranty applies on an "as installed basis," i.e., the warranty will confirm the panels were installed according to its requirements and specifications for installation. Moreover, the manufacturer shall have a minimum 10-year product warranty that ensures the products will be free from defects in materials and workmanship. The warranty shall last for ten (10) years from the date of purchase. The glass shall not cloud or discolor; the cable and connector plug shall function. The aluminum frames shall not suffer damage due to freezing.
  - 5. Be the same manufacturer, the same size, the same wattage, and the same model.
  - 6. Have a minimum 25-year design life, designed for normal, unattended operation.
  - 7. UL 1703 listed.
  - 8. UL listed for the specified voltage (typically 1000 V-DC).

9. Meet IEC 61215 (crystalline silicon PV modules) standards.
  10. Meet California SB1 Guidelines for Eligibility.
  11. CEC Certification: PV Modules shall be CEC Certified and shall meet all the requirements for being eligible for CSI Incentives. PV modules and inverters shall be on the California Energy Commission (CEC) list of approved products. Refer to <https://www.energy.ca.gov/programs-and-topics/programs/solar-equipment-lists>. Modules shall have a minimum CEC PTC rating of 89% of the nameplate. PV modules shall have a minimum rating of 16.5 watts per square foot DC.
  12. Each PV module shall include bypass diodes installed in the module junction box.
- B. Inverters shall meet the following:
1. Inverter(s) manufacturer, model and quantities shall match as per the approved plans or substitutions may be allowed upon approval by the EOR.
  2. String-type inverters with optimizer or add-on modules capable of providing rapid shut-down in accordance to CEC 690.12.
    - a. All power optimizers shall be compatible with modules and inverters to provide a fully functional photovoltaic system.
  3. Equipped with the following:
    - a. Integrated DC input disconnect.
    - b. Surge Protection
    - c. Ground fault interrupter
    - d. Data monitoring system
      - 1) System approved by the California Energy Commission that meets applicable state regulations.
  4. Include a minimum 10-year warranty with options for 15 and 20 years.
  5. Manufacturer produced no less than 250 MW of inverters in the prior fiscal year.
  6. Field-tested product line that has been commercially available for no less than 2 fiscal years.
  7. Comply with the following:
    - a. UL 1741 listed, inclusive of UL 1741-SA requirements.
    - b. IEEE 1547, including testing to IEEE 1547.1 and IEEE C62.45.
    - c. IEEE C62.41.2.
    - d. CPUC Electric Rule 21, California Energy Commission approved and utility line interactive type.
  8. Incorporate disconnect switch for main DC power disconnect in compliance with applicable codes and utility requirements.
  9. Sized as required to support the PV module production load within the rating of the equipment, together with all other components. Sizing shall not exceed 1.35 DC:AC ratio without approval by Owner and manufacturer.
  10. Meet the following requirements:
    - a. Nominal AC Voltage (Three-phase, + 10%): 208
    - b. Nominal AC Frequency (+ 0.5 Hz): 60 Hz
    - c. Line Power Factor (Above 20% rated power): >0.99
    - d. AC Current Distortion (At rated power): <5% THD
    - e. Maximum Open Circuit Voltage DC: 1,000 VDC
    - f. Maximum Ripple Current (% of rated current): <5%
    - g. Minimum Inverter Efficiency: >96%
    - h. Temperature Range Ambient: -4° F to 122° F (-20° C to 50° C)
    - i. Enclosure Environmental Rating (minimum): NEMA 3R (NEMA 4X within 5 miles of a marine environment or high dust area)
    - j. Relative Humidity (non-condensing): 0-95%

- k. Sound level: <85 dBa
  - l. Capable of producing reactive power to operate between a power factor of 0.9 lagging to 0.9 leading (as adjusted on the inverter equipment).
  - m. Protective Functions: Standard wakeup voltage, wakeup time delay, shutdown power, shutdown time delay, AC over / under voltage and time delays, AC over / under frequency and time delays, ground over current, over-temperature, AC and DC over current, DC over voltage
  - n. User Display: Standard-LCD with on/off capability and physical screen cover or other means of protection from UV exposure.
  - o. DC Disconnect: 600 VDC load break rated (or higher where DC voltage is higher).
  - p. Seismic Rating appropriate for the site and installation method.
  - q. Internal combiner panel option to allow connections of sub-arrays at the Inverter without the use of additional equipment.
- C. All equipment costs shall include all known and future duties, tariffs, export tariffs, customs, demurrage, and shipping costs.
- D. No substitution for contracted equipment shall be made without the written consent of Owner and EOR.
- E. Upon connection of the new PV systems, provide a placard on the respective Main Switchboard to identify the two sources of power feeding the equipment. Any existing signage related to legacy PV system shall be removed.
- F. Combiner boxes (where used) shall be NEMA 3R rated (minimum, NEMA 4X shall be used within 5 miles of a marine environment) and shall include fuses for string inputs and a bus bar to combine the strings into sub-arrays, for input into the Inverter system. Minimum combiner box output bus ampacity shall be 156% of the rated short circuit current available to be carried on the bus (the sum from all strings to the bus).
- G. All AC interconnecting feeders shall be sized per applicable sections of CEC Articles 310, 690 and 705. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per CEC. Provide equipment grounding conductor in each conduit.
- H. All roof and exterior mounted raceways shall be designed and installed to accommodate expansion and contraction due to heating affects, including adequate cable length and listed expansion couplings. All expansion couplings or installations shall include grounding bonding jumpers as required by code.
- I. All AC circuits to be 3-wire or 4-wire + ground, as required by inverter manufacturer's installation manual. All grounding per CEC 690, Part V.
- J. All DC circuits and feeders sized to CEC table 310.15(B)(16) (90-degree column). Minimum ampacity shall be 156% of the rated short circuit current available to be carried on the specific conductor. Conduit fill to 40% max. Include temperature derating as required for the ambient temperatures and roof conditions per CEC, and conduit fill derating as required. Provide equipment grounding conductor in each conduit.
- K. All DC circuits to be 2-wire + ground.

- L. AC conductors in raceways shall be Type THWN-2 or XHHW-2 for wet and dry locations. AC conductors shall be installed in raceways.
- M. DC PV string conductors shall be Type PV or USE-2/RHW-2 marked minimum 1000V and sunlight resistant. Exposed wiring shall be generally minimized and solely limited to the wiring immediately below the PV arrays.
- N. Above ground exposed conduit shall be rigid galvanized steel with threaded fittings except where AHJ and other applicable codes or specifications specifically allow for the use of EMT conduit. All conduit shall meet CEC Code, AHJ Guidelines and any applicable standards. Exterior installations shall have watertight fittings. All conduit shall be rated for exposed installation and a minimum design life equivalent to the solar panels. Paint all visible exposed raceways and boxes mounted on the side of buildings to match adjacent surface finish after installation. Colors to be selected and approved by the Owner.
- O. All interior conduit to be EMT with steel set-screw fittings (no cast fittings).

## 2.3 WIRE MANAGEMENT

- A. All wiring methods must meet or exceed current industry standards for wire management, strain relief and fastening.
- B. All DC string wire management shall use stainless steel or galvanized steel cable clips, Heyco or similar. UV rated cable ties shall be used minimally and only in locations where the use of cable clips is impossible.
- C. Wiring shall not be routed over sharp edges of structural members, equipment or modules.
- D. Wiring shall be routed under the modules of the array wherever possible to avoid direct exposure to the sun or elements.
- E. Wiring shall be secured under the array so as to prevent excessive slack resulting in wire motion, and to minimize visibility of inter-module and home run wiring to the public.
- F. Excess slack in the wire shall be secured such that it is in the module channel or secured to the junction box of the module. Factory-installed wire leads for modules can be wrapped around the junction box of the module.
- G. Where exposed, wires, cables and conductors shall be managed in a neat and orderly manner. Where exposed to environmental conditions (e.g., sunlight, rain, wind, etc.) and visible from below, wires shall be fastened in a uniform and discrete fashion.
- H. Strain relief and drip loops shall be utilized at all entrances to and from conduit bodies, junction boxes, weather heads, switchgear, inverters and panelboards etc. Conductors shall be strapped with strain relief as not to stress panel leads, home runs or mechanically crimped connections within the array. Sufficient slack shall be provided at both ends of cables to allow service and re-termination, and to prevent thermal expansion and contraction from stressing connections.
- I. Wire in switchboards, panelboards, meter cabinets, pull boxes, and other cabinets shall be neatly grouped and tied in bundles with nylon ties rated for the temperature rating of the

electrical equipment at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals and trained for straight entry into the terminals. At no point shall nylon ties be used on bussing or bussing used in any manner to support other materials including but not limited to circuit conductors.

- J. Maintain the conductor required bending radius per CEC and manufacturer specifications.
- K. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed and walls are completed.
- L. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. When pulling conductors, do not exceed manufacturer's recommended values.
- M. Conductor Color Codes
  - 1. AC Circuits (<600V): Conductors must be color-coded by phase and voltage as required by CEC, the AHJ, and the utility.
  - 2. DC Circuits, grounded: Positive-Red, Negative-White
  - 3. DC Circuits, ungrounded: Positive-Red, Negative-Black
  - 4. For phase and neutral conductors 6 gauge or larger, permanent thermoplastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.
- N. Conductor Identification
  - 1. All conductors, including DC homerun circuits, shall be labeled at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers.
  - 2. Labels shall indicate circuit or string and phase in accordance with the project drawings.
- O. Tape and Splice Kits
  - 1. Wire splice kits shall be UL listed for their manner of use, such as direct burial or wet operation. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with listed insulation approved by the manufacturer for use with the splice, or as contained in the listed splice kit. Free ends of conductors connected to energized sources shall be taped.
  - 2. Thermoplastic insulating material approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications. Standard electrical tape shall not be the sole insulation material for splices unless explicitly listed for use in the application and meeting the temperature rating of the insulation requirements for the splicing connection.
- P. Terminations
  - 1. Terminations of conductors shall be performed to the requirements and recommendations listed within the manufacturer manuals of the termination hardware and equipment where the termination shall occur.
  - 2. Conductors shall be terminated with minimal exposure of the bare conductor.
  - 3. Conductors cannot exceed the size and quantity restrictions of the lug. Contractor to verify equipment lugs supplied will accept the size and quantity of conductors shown in the project drawings.

4. Full engagement of the conductor within the lug must be maintained.
5. Provide necessary coating of anti-oxidation coating on all exposed conductor ends entering the lug.
6. Where mechanical connectors are used, torque all set-screws to manufacturer specifications with a calibrated torque wrench and indicate with torque marks. Torqueing electrical connectors "hand tight" is not allowed.
7. Where compression connectors are used, they must be installed with compression tools and dies approved by the manufacturer for use with the connector.
8. Ensure the final portion of the conductor before entering the termination is not part of a conductor bend (straight on entry).
9. Terminations of aluminum conductors cannot be made within 18 inches of earth/grade.
10. Termination fittings, connectors, and lugs must be rated and listed for the conductor metal type connected.

## 2.4 STRUCTURAL MOUNTING SYSTEMS AND GROUNDING

- A. The system shall be installed as part of a structural support system designed for the application and approved by the AHJ.
- B. Deviations from AHJ-approved construction drawings shall be documented with structural calculations and construction details; these engineering documents shall be submitted for AHJ approval prior to commencing any work.
- C. All mounting systems shall result in the installation of a PV system that meets all local applicable seismic and wind-load requirements, with a safety factor of at least 1.5.
- D. Array mounting hardware shall be compatible with the site considerations and environment. Special attention shall be paid to minimizing the risk from exposed fasteners, sharp edges, and potential damage to the modules or support structures, corrosion resistance, and durability of the mechanical hardware. The use of stainless-steel fasteners and aluminum support structures are required. The use of galvanized steel for the main support columns is acceptable and expected where metals come in contact with concrete. The use of wood is not acceptable.
- E. All equipment shall be from a manufacturer specializing in production of roof attachment products and racking materials of the type specified with a minimum of 5 years documented experience. All items of a given type shall be the products of the same manufacturer.
- F. The installation of solar systems on roofs shall adhere to the California State Fire Marshal Solar Photovoltaic Installation Guideline and California Fire Code requirements.
- G. Flat and low slope roofs:
  1. Design shall minimize interrow shading.
  2. Panel tilt shall be a minimum of 5 degrees.
- H. Roof attachments and stand-offs shall be installed per manufacturer's requirements and attached to the roof structure per structural requirements and as otherwise described in the construction documents. Copies of the manufacturer's mounting details and instructions shall be presented to the AHJ prior to installation. Moreover, attachments must be constructed in collaboration with the roofing manufacturer responsible for the roof and roofing material warranty to ensure that the roof warranty is not invalidated by the installation of the PV system.

- I. Roof attachments shall be made with an approved sealant. Coordinate with Architect for roof penetration sealing requirements.
- J. PV module attachment must be four-point equally distributed over the frame.
- K. Bolts/Nuts/Washers to hold down panels must be Stainless Steel and 5/16 or larger (304 or 316).
  - 1. Bolt must use a locking system like (Blue Lock Tight or nylon lock nuts) in addition to lock washers.
  - 2. All nuts/bolt under 12' from the ground and exposed to the public site shall be tamper proof (and approved by the AHJ).
- L. End caps shall be provided on all structural tubing.
- M. Hot galvanic coating shall be provided on all steel after all welding.
- N. Permeate heavy duty fall protection anchors "D" rings for OSHA fall protection of cleaning crews where fall protection is required by OSHA.
- O. All metal on the project except wires and wire connections shall be hot dipped galvanized, stainless steel, or anodized aluminum. (No Zinc coated, no painted, no uncoated hardware, bolts, bracing or braces is permitted.)
- P. PV arrays shall be seismically restrained from falling off the roof or excessive movement on the roof. Panels shall be installed to resist sliding and pop-up resulting from lateral and vertical seismic forces and displacements per CBC.
- Q. If PV modules are mounted to a racking system with module mounting clamps, the clamps must be approved for this purpose by their manufacturer as part of a UL 2703 listed assembly. Clamps shall be listed for PV module grounding to galvanized steel substrate, and their installation shall comply with the clamp installation manual and the PV module installation manual.
- R. All PV modules shall be bonded to each other and to the racking system or canopy galvanized steel structural purlins with listed PV module grounding devices and equipment grounding conductors. For a racking system, provide bonding straps between individual rails joining to form a multi-piece railing system. Moreover, an equipment grounding conductor shall ground the PV array to the PV inverter ground bar.
- S. Where PV modules and metallic parts of the racking system are grounded and bonded, contact between dissimilar metals such as copper and galvanized steel shall be avoided. Where contact cannot be avoided, outdoor-rated deox or conductive joint compound shall be applied between the interfacing metal surfaces.

## 2.5 SYSTEM ELECTRICAL

- A. The modules shall be interconnected using cable assemblies. The pigtails shall be quick-connect electrical wiring connections rated for the application (90-degree rated). DC string connectors for homerun wires and jumpers provide by the Contractor must match the make and model of

the connectors supplied with the PV module, or must be UL listed as compatible with the connectors supplied with the PV module.

- B. Raceway system shall be installed in a manner that prevents water from draining into electrical equipment.
- C. All major components of the systems and the installation procedures shall meet CEC requirements, including Articles 690 and 705.
- D. The PV system shall be designed to automatically drop offline when normal utility power is lost to avoid unintentional islanding effects as required by the local utility.
- E. All electrical system equipment shall be properly rated to withstand and interrupt (in the case of over current protection devices) the available fault current at the point of use
- F. All required overcurrent protection and electrical bussing sizes per CEC 690.
- G. Means of system grounding to be approved by professional Electrical Engineer of record and GFCI protection shall be in accordance with CEC requirements.
- H. Arc-fault protection where applicable per CEC 690.11.
- I. Add Rapid shut-down capability as applicable in compliance with CEC 690.12 requirements (Rapid Shutdown of PV Systems on Buildings).
- J. For PV system supply side interconnection (where applicable), the Contractor shall inspect the main service switchgear to confirm suitability of the switchgear supply side bus for interconnection of the PV system. Where required by the AHJ, any modification of the existing switchgear necessary to construct the supply side connection shall be approved by the switchgear manufacturer or a Nationally Recognized Testing Laboratory (NRTL). Where an NRTL approves modification of the switchgear, a field labeling report shall be provided to the Owner. The Contractor is responsible for obtaining switchgear manufacturer approval of any modification required to accommodate the supply side connection, or NRTL approval and report.
- K. Outdoor grounding connections between dissimilar metals (such as aluminum lugs and copper wire) will be protected against galvanic corrosion by the application of outdoor-rated deox or conductive joint compound between the interfacing metal surfaces.

## 2.6 MISCELLANEOUS SYSTEM REQUIREMENTS

- A. All exterior equipment to be sunlight and UV resistant as well as rated for elevated temperatures at which they are expected to operate (on roofs in hot sunlight).
- B. No dissimilar metals are allowed to contact each other (use deox, joint compound, plastic or rubber washers). Best practices shall be used to avoid corrosion.
- C. No aluminum in contact with concrete or masonry materials.
- D. Bolted connections shall be non-corrosive and include locking devices designed to prevent twisting over the design life of the PV system.



- E. Environmental impact of system equipment containing hazardous materials shall be disclosed, as well as maintenance and disposal instructions for equipment at the end of its useful life.
- F. The system shall be unshaded. No panel or equipment from the solar array shall create a shadow on any panel from 9 am to 4:15pm in the months from November 1 to March 15, and from 8am to 5:30 pm in the months from March 16 to October 31.

## 2.7 SYSTEM METERS, MONITORING, AND DATA ACQUISITION SYSTEM (DAS)

- A. Contractor shall provide the following monitoring instrumentation:
  - 1. Production Meter – A PV system production meter measuring the output of the solar array on a minimum 15-minute interval.
  - 2. Inverter Web Monitoring - Provide web monitoring module for each inverter (if multiple inverters are provided): factory installed module, detailed power data, energy output graphs for hourly, daily, weekly and monthly graphs of voltage vs. power output, data available for each inverter and the total system, energy output can be exported in spreadsheet format, online help.
- B. All measurement equipment must be “revenue” grade.
- C. Meters used shall be listed by the California Energy Commission.
- D. AC Power/Energy (including current transformers): Accuracy  $\pm 2\%$ .
- E. Data Acquisition and Monitoring System (DAS) shall be provided for all points of interconnect. The DAS shall include, but not be limited to, the measurement, calculation, display, and reporting of the following items:
  - 1. PV production in 15-min reporting intervals.
  - 2. Varying levels of summary data, including daily, weekly, monthly and yearly intervals.
  - 3. A minimum of 1-year of 15-min interval data shall be downloadable in a single instance.
  - 4. System electrical functions (instantaneous and accumulated power output (kW and kWh), AC and DC system voltage and amperage, and peak value tracking with associated time stamps).
  - 5. Pounds of CO<sub>2</sub> emissions avoided from the generation of PV energy at the site (compared to local utility fuel mix electric carbon content). CO<sub>2</sub> avoidance factor shall be readily customizable for the local utility.
  - 6. Capable of outputting data in the Western Renewable Energy Generation Information System (WREGIS) format sufficient for registering Renewable Energy Credits (RECs) from each system.
  - 7. Lifetime logging and access to data reported by DAS, including database-level, "unprocessed" data for lifetime of system operation.
  - 8. DAS shall provide access to all data through an open data exchange protocol (FTP Push or Application Program Interface (API)) to Owner and Owner's Third-Party Designee at no additional cost. This data shall, at a minimum, include PV production data, inverter production data, inverter AC power data, inverter current data, inverter voltage data, and alarm status readings. All data shall be available over multiple timescales, ranging from 15-min intervals to annual intervals and shall include both real- time and historic data.

- F. Contractor shall load software (as applicable) on Owner provided computers and train Owner in operation and maintenance of software or cloud-based systems and related monitoring functions.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all equipment and all required wiring for a complete and operational system. Follow manufacturer's guidelines for the installation of the array components, including mounting hardware and PV modules. Provide required conductor terminations to devices for a complete system to function as specified and indicated. Complete installation must comply with all local building codes, manufacturer's instructions, and applicable industry standards.
- B. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire as allowed in certain circumstances per manufacturer's instructions.
- C. In seismic areas, systems shall be adequately anchored and braced per details on structural contract documents to withstand seismic forces at the locations where installed.
- D. Wiring Installation: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on-site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. All cabling shall be mechanically fastened. If the system is roof-mounted it shall have direct current ground fault protection according to CEC. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.
- E. Instrumentation: Install instruments as recommended by the manufacturer. Locate control panels inside a room accessible only to qualified persons.
- F. Rack-Mounted Photovoltaic Installations: Rack-mounted photovoltaic modules shall be installed in accordance with the manufacturer's installation instructions.
- G. Remove, replace, patch, and repair existing roofing materials and surfaces cut or damaged during installation of the solar energy electrical power generation system, by methods and with materials so as not to void roofing system warranty. Notify roof warrantor before proceeding.
- H. Provide safety signage per CEC.
  - 1. All placards shall be machine generated phenolic type with red background and white lettering, affixed to equipment with stainless steel screws or with permanent adhesive where set screws are not feasible. Minimum lettering size to be 1/4" unless otherwise noted or required for legibility.
  - 2. In addition to CEC required signage, provide utility-required system directory placard and utility safety switch identification placard as required by local utility company, to identify all system components.

3. All DC disconnects, Junction boxes, DC feeders, AC feeders and termination points shall be labeled. Labeling shall match the as-built plans or drawings provided at the completion of the project. All conduits shall have voltages label at each end and no less than 10' apart labeling on all Electrical equipment. Contractor shall pay for and install all Arc flash protection labeling on all equipment they touch.

I. Utility Interconnection:

1. The Contractor shall complete the submissions for the utility interconnection agreement with the Owner's approval. The Contractor shall submit the required authorization form with the utility to act on behalf of the Owner. In the event that the Owner has already submitted interconnection applications, the Contractor shall take all responsibility for the interconnect process upon contract execution. The Contractor shall promptly review any past applications and begin coordination with the Utility for any proposed modifications to the system design. The Contractor shall ensure that any tariff grandfathering or other milestone achieved by the initial application is maintained. Should an issue arise that may jeopardize tariff grandfathering, some other utility milestone, substantially increase interconnection costs or the ability to interconnect the project, the Contractor shall promptly notify the Owner and seek approval from Owner before making any changes to the interconnect application.
2. The PV system at each Site shall not be interconnected with the Utility's distribution facilities until written authorization from the Utility Company has been obtained. Unauthorized interconnections may result in injury to persons and damage to equipment or property for which the installing contractor may be liable.

3.2 TESTING

- A. Photovoltaic modules shall be tested in the factory for design performance and results shall be included in the Operation and Maintenance manuals.
- B. Inverters shall be factory tested for performance and the results shall be included in the Operation and Maintenance manuals.
- C. System testing of the installed photovoltaic array shall be performed on all system strings and recorded in commissioning documentation and the Operation and Maintenance manuals.
- D. Performance testing to ASTM E2848-13 standard. Contractor shall define methodology within the protocol and obtain Owner's acceptance and notify owner before performing testing.
- E. Commissioning of PV Systems shall adhere to IEC 62446-1 requirements and shall include the following at a minimum:
  1. Conductors
    - a. AC & DC conductor inspection / megger. Insulation resistance and DC hi-pot testing of each AC and DC conductor, phase-to-phase and phase-to-ground.
    - b. Wire management check
    - c. DC string polarity, Voc & Isc testing and recording.
    - d. Confirm all conduits & junction boxes are installed properly/watertight.
  2. Inspection of DC fusing and disconnects.
  3. Inspection of AC components: AC Disconnect, Main Switch Board, AC Combiner Panel Boards, Breakers, Fuses, Terminations, Phasing, OCPD operation, etc.
  4. Grounding & bonding system inspection and continuity testing

5. Inverters
    - a. Inverter inspections and tests per manufacturer instructions.
    - b. Inverter start-up and confirm proper inverter settings.
    - c. Inverter output tests - Confirm PV system AC output as expected based on design, insolation and inverter readings.
  6. IV Curve Trace, Performance testing and recording.
  7. Thermal Imaging
    - a. Check all electrical components while systems are energized.
    - b. Spot check, Modules, Inverters, Disconnects, AC system, etc.
  8. Torque spot check on mechanical and electrical terminations
  9. Inspection of corrosion control measures.
  10. Confirm signage and placards meet plans.
  11. Workmanship evaluation.
  12. Inspection of DAS / CT metering and monitoring equipment.
  13. Confirm web-based monitoring interface operations.
  14. Commissioning of any other major electrical infrastructure installed on the project per manufacturer requirements.
- F. Testing to be performed per CPUC Electric Rule 21 testing procedures and requirements. All testing to be done on “no-cloud” days to avoid system fluctuation by passing clouds. Contractor to provide all testing and certification / commissioning.
- G. System start-up procedure shall be as outlined by the Manufacturer’s Installation Manual(s).
- H. Clean all equipment and PV modules prior to system start-up. PV modules shall be brush-cleaned with soap and water, and thoroughly rinsed.

### 3.3 TRAINING

- A. Provide full instructions to designated District personnel in the system’s operation, maintenance, and programming. Training shall be specifically oriented to installed equipment and systems. Minimum (2) 2-hour trainings.

### 3.4 DOCUMENTATION

- A. All commissioning and testing reports shall be provided to the Owner within 15 days of completion of testing.
- B. The Contractor shall submit to the Owner a comprehensive Operations and Maintenance (O&M) manual for each system. O&M Manuals shall be compiled as a single, bookmarked portable document format (PDF) file. The document shall be a well-organized, comprehensive and custom document created with details for each site. The document shall include at a minimum the following:
1. System description and overview
  2. Simplified site plan that shows array naming convention, inverter locations, and disconnects
  3. Safety Details, including shut down procedures
  4. Contact information for the system installer and maintenance personnel
  5. Monitoring system login and operation details

6. Standard procedures for both Owner and O&M personnel
7. Maintenance information, including schedules and responsibilities for ongoing maintenance
8. Troubleshooting and repair, including responses to typical issues and responsible parties
9. Summary table with the following details for each site: Site, System Size, Permission-to-Operate (PTO), Commercial Operation Date (COD), Final Completion Date, AHJ Closeout Date
10. Any other information that may be required for the Owner to easily and safely interact with, confirm performance, troubleshoot, maintain and/or service the materials and equipment installed under this Contract.
11. O&M Attachments shall include:
  - a. Permission-to-Operate (PTO) notice and any other pertinent Utility documentation
  - b. As-built Record Drawings in PDF format (single compiled file for each site), provided as separate file from the fully compiled O&M Manual PDF. The updated as-built drawings shall also include the following details:
    - 1) DC string maps with corresponding inverter nomenclature (ID), locations, serial numbers, azimuth, and tilt.
    - 2) Data logger make, model and serial number
  - c. Material List - Complete material list of all items furnished and installed, including but not limited to the following: PV Modules, inverters, wiring, combiner boxes, panelboards, switch gear, optimizers, disconnects, boxes, metering and DAS equipment.
  - d. All warranties, cut sheets, and manuals for major equipment.
  - e. System testing and commissioning documentation.

### 3.5 FINAL ACCEPTANCE

- A. The acceptance of the solar PV system occurs only after all deficiencies identified by the performance tests and commissioning report are corrected and the system operates successfully during a 30-day initial testing period.
- B. The Owner must sign appropriate certificates, if equipment and systems are operating satisfactorily in accordance with the specifications, stating the system's operation has been tested and accepted at the end of the final start-up and testing.

END OF SECTION

## SECTION 26 51 00 – INTERIOR LIGHTING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:
  - 1. Interior lighting systems, including luminaires, ballasts, lamps and emergency lighting equipment.
- B. Related Work:
  - 1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
  - 3. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
  - 4. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
  - 5. Section 26 56 00, EXTERIOR LIGHTING.
  - 6. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting, details, materials, terminations, wiring and connection diagrams, photometric data, ballasts, luminaires, lamps and controls.

## 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM).

- C. American National Standards Institute (ANSI).
- D. Aluminum Association Inc. (AA).
- E. Illuminating Engineering Society of North America (IESNA).
- F. National Electrical Manufacturers Association (NEMA).
- G. National Fire Protection Association (NFPA).
- H. Underwriters Laboratories, Inc. (UL).

## 1.5 DEFINITIONS

- A. Lighting terminology used herein is defined in IES
- B. Exception: The term “driver” is used herein to cover both drivers and power supplies, where applicable.
- C. Clarification: The term “LED light source(s)” is used herein per IES to cover LED package(s), module(s), and array(s).

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, and as shown on the drawings and specified.

### 2.2 LIGHTING FIXTURES (LUMINAIRES)

- A. Shall be in accordance with NFPA 70, UL 1598 and shall be as shown on drawings and as specified. All luminaires shall have been certified to the California Energy Commission by its manufacturer to comply with the efficiency standards as per California Code of Regulations Title 24, Part 6, Section 111 referencing the Appliance Efficiency Regulations in Title 20. Post certification with building permit.
- B. Sheet Metal:
  - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
  - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
  - 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
    - a. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

- C. Luminaires shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers.
- D. Recessed fixtures shall be of the type approved for the ceiling and insulation conditions and appropriate for the installation location. Insulation must be held back from the fixture to provide manufacturers' recommended clearances for proper operation. Thermal tripping shall be the installer's responsibility to correct. Where installed in fire rated ceilings, coordinate installation of fire rated enclosures around the ceiling penetrations. Fixtures shall contain the proper through wiring capacity for that which is shown on the plans.
- E. Recessed fixtures shall be provided with the appropriate trims and hardware compatible with the ceiling type shown. Plaster frames are required where plaster or gypsum board ceilings are encountered.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
  - 1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
  - 2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise specified on the drawing.
  - 3. Exterior finishes shall be as shown on the drawings.
- H. Provide all lighting fixtures with a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Recessed LED fixtures shall be manufactured specifically for LED lamps with drivers integral to the fixture. Assemblies designed to retrofit fixtures are prohibited except when described in this fashion. Fixtures shall be designed for lamps as specified.
- J. Provide wire lamp guard on all exposed lamp fixture/luminaires.
- K. Provide fixtures with a U.L. listing for shower or shower rating above shower or tub areas.

## 2.3 LED LUMINAIRE REQUIREMENTS

- A. General Requirements:
  - 1. Luminaire shall have an external label per ANSI C136.15
  - 2. Luminaire shall have an internal label per ANSI C136.22.
  - 3. Luminaires shall start and operate in -20°C to +40°C ambient.
  - 4. LED light source(s) and driver(s) shall be RoHS compliant.



## 2.4 EMERGENCY LAMP POWER SUPPLY

- A. Self-contained battery-operated power supply for operating luminaire lamp(s) for a minimum output of 90 minutes.
- B. The power supply shall be installed within the luminaire driver compartment or wireway. Provide with test switch and charge indicator installed integral to the luminaire. The test switch and charge indicator may be installed in a remote ceiling mounted flush J-box for recessed downlights which cannot accept integral components.
- C. Performance: Emergency operation lumen output for lamps shall be a minimum of 1100 lumens. Emergency operation lumen output for downlight lamps shall be a minimum of 640 lumens. Unless specifically noted otherwise on the associated electrical drawings.
- D. Provide access hatches, for emergency battery backup ballasts, adjacent to recessed 6-inch or less diameter downlights installed in inaccessible ceilings.
- E. Manufacturers: Bodine, Iota, or approved. Emergency lamp power supplies may be provided as factory installed by the luminaire manufacturer provided the product meets the above specification criteria.
- F. Shielding: All lens material shall be 100% virgin acrylic, .125" minimum thickness, unless otherwise indicated in the fixture schedule.
- G. Maintain accessibility of all driver / power supply locations.

## 2.5 LED DRIVER

- A. Driver
  - 1. Rated case temperature shall be suitable for operation in the luminaire operating in the ambient temperatures as indicated.
  - 2. Shall accept the voltage or voltage range indicated, and shall operate normally for input voltage fluctuations of plus or minus 10 percent. Consistent with NEMA SSL 1.
  - 3. Shall have a minimum Power Factor (PF) of 0.90 at full input power and across specified voltage range.
- B. Electromagnetic interference
  - 1. Shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
  - 2. Shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- C. The following shall be in accordance with corresponding sections of ANSI C136.37
  - 1. Wiring and grounding
  - 2. All internal components shall be assembled and pre-wired using modular electrical connections.
  - 3. Mounting provisions
  - 4. Terminal blocks for incoming AC lines
  - 5. Latching and hinging
  - 6. Ingress protection

## 2.6 LAMPS

- A. Provide lamps for all luminaires.
- B. LED LIGHT SOURCE
  - 1. Minimum Color Rendering Index (CRI): 60.
  - 2. Correlated Color Temperature (CCT)
    - a. CCT shall be as listed in Table 1 below:

Table 1. Allowable CCT

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values Measured CCT (K)
2700	2580 to 2870
3000	2870 to 3220
3500	3220 to 3710
4000	3710 to 4260

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation and furnishing of lighting fixtures shall be in accordance with the CEC, manufacturer's instructions and as shown on the drawings or specified. Fixtures damaged in transit and storage prior to completion shall be replaced at Contractor's expense.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect. The Architectural reflected ceiling plan will take precedence over electrical plans.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.
- E. Lighting Fixture Supports:
  - 1. Contractor shall provide support for all of the fixtures independent of suspended ceilings. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
  - 2. Shall maintain the fixture positions after cleaning and relamping.
  - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
  - 4. Hardware for recessed fluorescent fixtures:
  - 5. Fixtures shall be supported as detailed on drawings and as required by DSA standards.
  - 6. Installation: Fixtures shall be securely mounted on ceilings and walls with appropriate fastening devices. "Drop-in" type T-bar fixtures shall be secured with #12 gauge safety "earthquake wires" as described by California Code of Regulations Title 24 Part 2, Chapter 47. "Earthquake clips" will be required for fastening to the T-bar system in addition to safety wire. Surface mounted fluorescent fixtures shall be solidly screwed or

clipped into framing above drywall with 4-#10 sheet metal screws into each fixture. Provide blocking for screw supports behind all surface mounted lighting fixtures weighing more than 15 lbs.

7. Surface mounted lighting fixtures:
    - a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts shall be minimum 1/4-20 bolt, secured to structural ceiling. Non-turning studs may be attached to the building structure by 12 gauge safety hangers.
  8. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
  9. Single or double pendent mounted lighting fixtures:
    - a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure and be allowed to swing to a 45 degree angle.
  10. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- F. Furnish and install the specified lamps for all lighting fixtures as part of this project.
- G. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- H. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- I. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all fixtures, lenses, diffusers and louvers that have accumulated dust/dirt during construction.
- J. Provide unswitched leg of interior lighting branch circuit to integral emergency battery pack light fixtures, exit signs and night lights as applicable per lighting plans.
- K. Wallmount fixtures in walkway areas shall not project more than 4 inches from wall when projection occurs lower than 80 inches.

END OF SECTION

## SECTION 26 56 00 – EXTERIOR LIGHTING

## PART 1 - GENERAL

## 1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of exterior luminaires, controls, poles and supports.

## 1.2 RELATED WORK

- A. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
- C. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 51 00, INTERIOR LIGHTING.
- F. Section 26 56 70, LIGHTING ACCEPTANCE TESTING.

## 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, effective projected area (EPA), lamps and controls.

## 1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM).

- C. American Concrete Institute (ACI).
- D. American National Standards Institute (ANSI).
- E. Aluminum Association Inc. (AA).
- F. Illuminating Engineering Society of North America (IESNA).
- G. National Electrical Manufacturers Association (NEMA).
- H. National Fire Protection Association (NFPA).
- I. Underwriters Laboratories, Inc. (UL).

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Poles: Do not store poles on ground. Store poles so they are at least one foot above ground level. Do not remove factory-applied pole wrappings until just prior to installation of pole.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be in accordance with CEC, UL, ANSI, as shown on the drawings and as specified.

#### 2.2 POLES

- A. General:
  - 1. Poles shall be steel or aluminum as specified in fixture schedule and as shown on the drawings. Finish shall be as approved by the Architect. Assume custom color for bidding.
  - 2. The pole and arm assembly shall be designed for wind loading of 100 miles per hour, with an additional 30 percent gust factor, supporting luminaire(s) having the effective projected areas indicated as per manufacturer data.
  - 3. Poles shall anchor-bolt type designed for use with underground supply conductors. Poles shall have gasketed handhole with a minimum clear opening of 2.5" x 5". Handhole cover shall be secured by stainless steel captive screws.
  - 4. Provide a steel grounding stud opposite hand hole openings.
- B. Provide a base cover matching the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.
- C. Hardware: All necessary hardware shall be 300 series tamperproof stainless steel.
- D. Types:
  - 1. Aluminum: Provide aluminum poles manufactured of corrosion resistant AA AAH35.1 aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5

for wrought alloys, and Alloy 356-T4 (3,5) for ASTM B108-01 cast alloys. Poles shall be seamless extruded or spun seamless type. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Base covers for aluminum poles shall be cast from 356-T6 aluminum alloy in accordance with ASTM B108-01.

2. Steel: Provide steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and iron-oxide primed factory finish. Base covers for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield of 36,000 psi.

## 2.3 FOUNDATIONS FOR POLES

- A. Foundations shall be cast-in-place concrete.
- B. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and all accessories specified under wind conditions as specified in this section.
- C. Place concrete in spirally wrapped treated paper forms for round foundations, and construct forms for square foundations.
- D. Rub-finish and round all above-grade concrete edges to approximately 1/4" radius unless otherwise detailed.
- E. Concrete shall have 3000 psi minimum 28 day compressive strength.
- F. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings and meet ACI 318. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- G. Install a copperclad ground rod, not less than 5/8" diameter by 10' long in pullbox adjacent to each fixture. Where rock or layered rock is present, drill a hole not less than 2" in diameter and 6' deep, backfill with tamped fine sand and drive the rod into the hole. Bond the rod to the pole with not less than number 6 AWG bare copper wires. The method of bonding shall be approved for the purpose.
- H. After leveling of pole grout base solid between plate and footing with dry pack concrete for vibration reduction.

## 2.4 LUMINAIRES

- A. UL 1598 and ANSI C136.17. Luminaries shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat and safe cleaning and relamping.
- B. Light emitting diode (LED)-based solid state lighting (SSL) products shall be factory tested in accordance to the International Engineering Society (IES) LM-79 recommendations and meet ANSI C78.377-2008 standards.
- C. LED light sources shall be factory tested in accordance to IES LM-80 recommendations.
- D. LED-based SSL product shall incorporate an external heat sink, integral to the luminaire.

- E. IESNA HB-9 and RP-8 light distribution pattern types shall be as indicated on the drawings.
- F. Incorporate associated ballasts and drivers within the luminaire housing.
- G. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by hinges or chain.
- H. Pre-wire internal components to terminal strips at the factory.
- I. Bracket mounted luminaires shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
- J. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- K. LED-based SSL luminaires shall be manufactured specifically for LED lamps with drivers integral to the luminaire housing.

## 2.5 LAMPS

- A. Luminaires shall be listed for the lamp specified on the associated electrical plans. Install the proper lamps in every luminaire installed.
- B. Lamps shall be clear or coated as recommended by luminaire manufacturer to provide for maximum luminaire efficiency in fixture used.

## 2.6 LED-BASED SOLID STATE DRIVERS

- A. Shall be listed by either U.L. or equal listing agency and comply with IEEE C.62.41-1991, Class A operation.
- B. Provide a minimum power factor of 0.9.
- C. Minimum operating temperature appropriate for outdoor environments.
- D. Shall operate at a frequency greater than or equal to 120Hz.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install lighting in accordance with the CEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Poles:
  - 1. Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 1.57 rad 90 degrees at the bottom end. Provide galvanized nuts, washers, and ornamental covers for anchor bolts. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit

- elbow. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
2. After the poles have been installed, shimmed and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 3/8" inside diameter, through the grout tight to the top of the concrete base for moisture weeping.
  3. Attach pole base cover to pole flange with set screws.
- C. Foundation Excavation: Depth shall be as indicated on drawings. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6" maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.
- D. Photocell Switch Aiming (where applicable): Aim switch according to manufacturer's recommendations. Mount switch on or beside each luminaire when switch is provided in cast weatherproof aluminum housing with swivel arm or set adjustable window slide for proper footcandles photocell turn-on.

### 3.2 GROUNDING

- A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or alloyed connectors suitable and listed for this purpose.

END OF SECTION



## SECTION 26 56 70 - LIGHTING ACCEPTANCE TESTING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. This Section Includes:

1. The Contractor shall be responsible for the Certificate of Acceptance, but coordinate with the Certified California Lighting Controls Test Technician to assure that all required documents have been filed with and approved by the enforcement agency prior to receiving a final occupancy permit. The Certificate of Acceptance will indicate that the Contractor has demonstrated acceptance requirements of the plans and specifications, that current requirements for installation certificates are met, and that currently required operating and maintenance information (as well as the Certificate of Acceptance) were provided to the building Owner.
2. Testing, evaluation and calibration of lighting controls equipment provided, installed and connected in Division 26.
3. Documentation of test results, completion of "Certificate of Acceptance" and "Certificate of Installation" forms and filing with the enforcement agency for approval.
4. Specific Jobsite Conditions:
  - a. Acceptance testing must be tailored for each specific design, job site, and climactic conditions. While the steps for conducting each test remain consistent, the application of the tests to a particular site may vary. The Contractor shall review the construction documents and include all required time, material, testing equipment, etc. as required to complete the requirements of this section.

## B. Related Work:

1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
2. Section 26 51 00, INTERIOR LIGHTING.
3. Section 26 56 00, EXTERIOR LIGHTING.
4. Section 26 09 26, LIGHTING CONTROL SYSTEM.
5. Section 26 09 23, OCCUPANCY SENSORS.

## 1.3 REFERENCES

- A. Acceptance Testing Criteria: 2022 Building Energy Efficiency Standards Non-Residential Compliance Manual.

## 1.4 SYSTEM DESCRIPTION

- A. Performance Requirements:

1. All material, equipment, labor and technical supervision to perform tests, calibrations and documentation specified herein.
- B. Scope of Testing, Evaluation and Calibration (as applicable):
  1. Automatic (master) time switches.
  2. Occupancy sensors.
  3. Automatic daylighting controls.
  4. Photo electric sensors.
  5. Daylighting controls.
  6. Outdoor astronomical time switches.
  7. Area controls.

## 1.5 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Test Reports:
  1. Written record of all tests and completion of forms included in this section.
  2. At completion of project, assemble a final test report. Submit report to the enforcement agency and the Owner prior to final occupancy to include:
    - a. Summary of project.
    - b. Description of systems and equipment tested.
    - c. Visual inspection report.
    - d. Description of tests.
    - e. Test results.
    - f. Conclusions and recommendations.
  3. Report shall be bound in booklet form, include on the Contractor's letterhead the title of the report and the systems tested.
- C. Constructability Plan Review
  1. The Contractor shall review the construction drawings and specifications to understand the scope of the acceptance tests and raise critical issues that might affect the success of the acceptance tests prior to starting construction. Any constructability issues associated with the lighting system should be forwarded to the design team for review/modifications prior to equipment procurement and installation. The Contractor shall submit on company letterhead, with the lighting control equipment required by Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, 1.4B, a letter confirming that the constructability review has been completed and their company has reviewed and is prepared to complete the lighting acceptance testing required by this section.

## PART 2 - PRODUCTS

### 2.1 FORMS

- A. Lighting Installation forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the following California Energy.ca.gov website.

- B. Lighting Acceptance forms are to be provided by a Certified California Lighting Controls Acceptance Test Technician. The California Energy Commission adopted changes to the California building Efficiency Standards (Title 24, Parts 1 and 6) that require lighting controls and devices to be certified as properly installed and operational, prior to issuance of occupancy permits. All Acceptance Technicians must be Certified California Lighting Controls Acceptance Test Technicians and employed by an Acceptance Test employer that provides support as well as quality control.
- C. These completed forms will be the deliverable product to the enforcement agency and Owner as described in 1.4 of this section.

### PART 3 - EXECUTION

#### 3.1 FIELD QUALITY CONTROL

- A. Tests:
  - 1. Contractor's Responsibilities:
    - a. Perform all required tests required by this section.
    - b. Schedule testing with building Owner.
    - c. Provide Installation forms
    - d. Acceptance forms provided by California Certified Lighting Controls Technician hired by Contractor.
    - e. Calibration of equipment such as light meters, photo electric controls, etc.
    - f. Programming of time switches (interior/exterior lighting) for operations as directed by the Owner.

#### 3.2 ADJUSTING

- A. Final Settings: The Contractor shall be responsible for implementing all final settings and adjustments on controls equipment as required for a complete and operating system.

END OF SECTION

## SECTION 27 13 00 - INTERCOMMUNICATION SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:

1. Telecommunications Cabling at the new or remodeled buildings for the project. Backbone and horizontal cabling comprised of copper and fiber cabling, and support systems are covered under this document.
2. The Horizontal (workstation) Cabling System shall consist of a minimum of three (3) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor, and routed to the appropriate rack serving that area and terminated as specified in this document.
3. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor as detailed in this document.
4. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

## 1.3 REGULATORY REFERENCES

- A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the local Electrical Code and present manufacturing standards.
- B. All materials shall be UL Listed and shall be marked as such. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.
- C. All modular jacks, patch cords, consolidation point, and patch cords performance shall be verified (not just tested) by a third party to be category 6A component and channel compliant.

- D. The cabling system described in this is derived from the recommendations made in recognized telecommunications industry standards. The following documents are incorporated by reference:
1. ANSI/TIA/EIA - 568-C.0, Generic Telecommunications Cabling for Customer Premises
  2. ANSI/TIA/EIA - 568-C.1, Commercial Building Telecommunications Cabling Standard.
  3. ANSI/TIA/EIA - 568-C.2, Balanced Twisted Pair Cabling Components, Addendum 1 –
  4. ANSI/TIA/EIA - 568-C.3, Optical Fiber Cabling Components
  5. ANSI/TIA/EIA – 569-A, Commercial Building Standard for Telecommunications Pathways and Spaces, February, 1998.
  6. ANSI/TIA/EIA – 606-A, Administration Standard for Telecommunications Infrastructure of Commercial Buildings, February, 2002.
  7. ANSI/TIA/EIA – 607-A, Commercial Building Grounding and Bonding Requirements for Telecommunications, August, 1994.
  8. ANSI/ TIA/EIA – 758, Customer-Owned Outside Plant Telecommunications Cabling Standard, April 1999.
  9. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM) – Current Edition.
  10. California Electrical Code (CEC) –2022.
- E. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- F. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

#### 1.4 APPROVED CONTRACTOR

- A. The Telecommunications Contractor must be a Certified Installer for the products and/or system being supplied. A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with said certification. At least (1) for every (3) members of the copper installation and termination crew must be certified to a Technician Level of training by the product manufacturer or BICSI. At least (1) for every (5) members of the optical fiber installation and termination crew must be certified by the product manufacturer or other approved organizations in Optical Fiber installation and termination practices.

#### 1.5 WORK INCLUDED

- A. The work included under this specification consists of furnishing all labor, equipment, materials, and supplies and performing all operations necessary to complete the installation of this structured cabling system in compliance with the specifications and drawings. The Telecommunications contractor will provide and install all of the required material to form a complete system.
- B. The work shall include, but not be limited to the following:
1. Furnish and install a complete telecommunications wiring infrastructure as described on the plans and in these specifications.

2. Furnish, install, and terminate all UTP and Optical Fiber cable.
3. Furnish and install all wall plates, jacks, patch panels, and patch cords.
4. Furnish and install all required cabinets and/or racks as required and as indicated.
5. Furnish any other material required to form a complete system.
6. Perform link testing (100% of horizontal and/or backbone links) and certification of all components.
7. Furnish test results of all cabling to the owner on disk and paper format, listed by each closet, then by workstation ID.
8. Adhere and comply with all requirements of the product certification and warranty programs (sufficient to be able to provide and extend the manufacturer's extended warranty).
9. Provide owner training and documentation. (Testing documentation and As-built drawings).

#### 1.6 SUBMITTALS

- A. Under the provisions of this request for proposal, prior to the start of work the telecommunications contractor shall:
  1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
  2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
  3. Submit appropriate cut sheets and samples for all products, hardware and cabling with highlighted or otherwise denoted specific products to be used. If product cut-sheets are submitted without specific products highlighted the engineer shall return submittal immediately with "Revise and Resubmit" response.
- B. Work shall not proceed without the Owner's approval of the submitted items.
- C. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.

#### 1.7 QUALITY ASSURANCE

- A. The telecommunications contractor shall staff the project with qualified personnel. All products shall be new and in good condition.

#### 1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and receipt of products shall be at the site described in the Scope Section.
- B. Cable shall be stored according to manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage

location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable shall be stored off site at the contractor's expense.

- C. If the telecommunications contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

## 1.9 DRAWINGS

- A. It shall be understood that the electrical details and drawings provided with the specification package are diagrammatic. They are included to show the intent of the specifications and to aid the telecommunications contractor in bidding the job. The telecommunications contractor shall make allowance in the bid proposal to cover whatever work is required to comply with the intent of the plans and specifications.
- B. The telecommunications contractor shall verify all dimensions at the site and be responsible for their accuracy.
- C. Prior to submitting the bid, the telecommunications contractor shall call the attention of the Engineer to any materials or apparatus the telecommunications contractor believes to be inadequate and to any necessary items of work omitted.

## PART 2 - PRODUCTS

### 2.1 EQUIVALENT PRODUCTS

- A. The Owner and engineer have selected specific products that achieve the desired level of performance and preference. The project has been designed around said products. Proposed substitutions must demonstrate equivalent performance in all areas to the satisfaction of the Owner and must be submitted for review at least 10 days prior to bid. The Owner shall not be required to entertain substitutions submitted after bid.

### 2.2 WORK AREA OUTLETS

- A. Work area cables shall each be terminated at their designated work area location in the connector types described in the subsections below. Included are modular telecommunication jacks. These connector assemblies shall snap into a faceplate.
- B. The Telecommunications Outlet Assembly shall accommodate:
  - 1. A minimum of three (3) modular jacks, arranged into (1) 1-gang faceplate by Leviton (Quickport series no substitutions).
  - 2. Additional accommodations for specific locations as noted in the plans for optical fiber and/or additional copper cables as necessary.
  - 3. A blank filler (matching in color to indicated faceplate color) will be installed when extra ports are not used.
  - 4. All modular jacks shall have their circuit number on the faceplate identifier strip.
  - 5. Multiple jacks that are identified in close proximity on the drawings (but not separated by a physical barrier) may be combined in a single assembly. The telecommunications

contractor shall be responsible for determining the optimum compliant configuration based on the products proposed.

6. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the telecommunications contractor shall submit the proposed configuration for each outlet assembly for review by the Owner.
7. The modular jack shall incorporate printed label strip on the dust cap module for identifying the outlet. Printed labels shall be permanent and compliant with ANSI/TIA/EIA-606-A standard specifications. Labels shall be printed using a printer such as a Brady hand held printer. Hand printed labels shall not be accepted.

C. Faceplates: The faceplates shall:

1. Be as appropriate to fit the modular jack used.
2. Be UL listed and CSA certified.
3. Be constructed of high impact, ABS plastic UL 94V-0 construction (except where noted otherwise).
4. Shall be Off-White in color.
5. Be compliant with the above requirements along with the following when incorporating optical fiber:
  - a. Be a low profile assembly,
  - b. Incorporate a mechanism for storage of cable and fiber slack needed for termination,
  - c. Position the UTP modular jack to face downward or at a downward angle
  - d. Position the fiber optic couplings to face downward or at a downward angle to prevent contamination and,
  - e. Incorporate a shroud that protects the optical couplings from impact damage.
6. Be available as single-gang or dual-gang.
7. Provide easy access for adds, moves, and changes by front removal of jack modules.
8. Possess recessed designation windows to facilitate labeling and identification.
9. Include a clear plastic cover to protect labels in the designation window.
10. Have mounting screws located under recessed designation windows.
11. Comply with ANSI/TIA/EIA-606-A work area labeling standard.
12. Allow for the UTP modules to be inverted in place for termination purposes.
13. Be manufactured by an ISO 9001 registered company.
14. Acceptable products as follows (no substitutions will be allowed):
  - a. Leviton Quickport compatible with Atlas and eXtreme modular jacks.
  - b. Leviton Quickport blank modules where a blank filler is required.

D. Voice / Data Jacks (Telecommunications Jacks)

1. Voice/Data jacks, also known as telecommunications jacks, shall be 8-position modular jacks and shall be Category 6A performance as defined by the references in this document including ANSI/TIA/EIA-568-C.2. All pair combinations must be considered, with the worst-case measurement being the basis for compliance. Modular jack performance shall be third-party verified by a nationally recognized independent testing laboratory.
2. The modular jack shall use dual reactance modular contact array.
3. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.
4. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6A specifications.
5. The modular jack shall have low emission IDC contacts.



6. The modular jack shall use standard termination practice using 110 impact tool or manufacturer approved tool using trained technician.
7. The modular jack shall be backwards compatible to Category 3, 5, 5e, and 6.
8. The modular jack shall be center tuned to category 6A test specifications.
9. Dust covers shall be used on each termination.

### 2.3 110 COPPER TERMINATION BLOCK

- A. The voice cross connect shall be a passive connection between the horizontal termination blocks and the backbone termination blocks. The wall mount frames shall be field terminated kits including all blocks, connecting blocks, and designation strips. Management rings shall be mounted between vertical columns of blocks to provide management of cross-connect wire. Backbone and horizontal blocks shall use 4-pair connecting blocks. Blocks shall be oriented so that backbone terminations are located on the left and horizontal frames are located on the right of the termination field when facing the frame assembly.
- B. 110 Block Kits shall:
  1. Include both the wiring block in a 50, 100 and 300 pair (as applicable) footprint and the connecting block.
  2. Be manufactured using fire retardant molded plastic.
  3. Support termination of 22-24 AWG solid conductor.
  4. Contain back openings for the feed through of cable.
  5. Meet category 6 component compliance and be verified by a third-party nationally recognized independent testing laboratory.
  6. Have color-coded tips on the wiring block and color-coding on the connector blocks for installation identification.
  7. Use standard termination practice requiring a single conductor 110 impact tool, or manufacturer approved methods.
  8. Termination hardware shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
  9. Be backwards compatible to category 3, 5 and 5e.
  10. Be labeled in compliance with ANSI/TIA/EIA-606-A labeling specifications using permanent labels and LabelMo software (or other labeling software/printer).
  11. Be manufactured by an ISO 9001 registered company.

### 2.4 MODULAR PATCH PANELS

- A. The Modular Patch Panels shall:
  1. Meet category 6A component compliance and be verified by a third-party nationally recognized independent testing laboratory.
  2. Use low emission IDC contacts.
  3. Use dual reactance technology to enhance the signal-to-noise ratio.
  4. Require standard termination practices using a 110 impact tool or manufacturer approved methods. Where modular jacks are used, EC shall use patch panel that accepts modular jacks as specified in Section 2.2(D) above.
  5. Use a single piece IDC housing designed to accept larger Category 6A conductors.
  6. Support both T568B and T568A wiring.
  7. Include easy to follow wiring labels.
  8. Include label fields.

9. Allow for the use of icons.
10. Include full length metal rear cable management.
11. Be available in standard or high density.
12. Be backward compatible to category 3, 5, 5e, and 6.
13. Be center tuned to category 6A test specifications.
14. Be 24-port in any given 1 rack-units
15. Acceptable products as follows (no substitutions will be allowed):
  - a. Leviton Quickport 49255-H24

## 2.5 RACKS

- A. All racks and wire management shall be of one manufacturer or designed specifically to work together. The equipment rack shall provide vertical cable management and support for the patch cords at the front of the rack and wire management, support, and protection for the horizontal cables inside the legs of the rack. Waterfall cable management shall be provided at the top of the rack for patch cords and for horizontal cables entering the rack channels for protection and to maintain proper bend radius and cable support. Wire management shall also be mounted above each patch panel and/or piece of equipment on the rack. The rack shall include mounting brackets for cable tray ladder rack to mount to the top of the rack. Velcro cable ties shall be provided inside the rack channels to support the horizontal cable. Rack shall be black in color to match the patch panels and cable management.
- B. Free-Standing Rack
  1. Free-standing rack shall:
    - a. Provide the necessary strain relief, bend radius and cable routing for proper installation of high performance cross connect products, meeting all specifications of ANSI/TIA/EIA-568-C.
      - 1) Rear channels to securely route distribution cables.
      - 2) Vertical management "cage" to protect patch cords while allowing easy access for moves, adds and change with individual 1-rack unit fingers and double hinged door.
      - 3) Include speednuts to reduce assembly time.
    - b. Have top cable trough with waterfall and built in patch/horizontal cable distribution separator.
    - c. Have EIA hole pattern on front and rear.
    - d. Have rack units stamped on the front, on both sides allowing numbering from top-to-bottom or bottom-to-top.
    - e. Be available with a 10.5" or 16.25" channel depth.
    - f. Be available with hook and loop straps for securing bulk cables inside the vertical U-channels.
    - g. Assemble as 19" (483 mm) or 23" (584 mm) with no additional hardware.
    - h. Be available with three styles of vertical patch cord management: interbay with latches, cable management rings, or fingerduct with covers.
    - i. Provide floor and ceiling access for cable management and distribution.
    - j. Provide pre-drilled base for floor attachment of rack.
    - k. Be available in a 7 foot version (45 rack units).
    - l. Be available in standard color of black.
    - m. Be manufactured by an ISO 9001 registered company.
    - n. Acceptable products as follows:
      - 1) Chatsworth #46353-703, 45-RU 2-post rack, black (or approved equal).

## 2.6 HORIZONTAL DISTRIBUTION CABLE

- A. All horizontal data station cable and voice cable shall terminate on modular patch panels (copper or fiber), 110 cross-connecting blocks (copper), or patch/splice cabinets (fiber) in their respective Telecommunications Room or Equipment Room as specified on the drawings.
- B. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)
1. Physical Characteristics:
    - a. Shall be plenum rated only and meet applicable requirements of ANSI/ICEA S-80-576. All 4 pairs must be insulated with F.E.P. No 2 x 2 or 3 x 1 constructions will be allowed.
    - b. The diameter of the insulated conductor shall be .023 in. maximum.
    - c. Shall consist of (4) twisted pairs.
    - d. Shall be suitable for the environment in which they are to be installed.
    - e. The color coding of pairs shall be per T-658B color coding scheme:  

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR
    - f. The overall diameter of the cable shall be no larger than 0.320" nominal.
    - g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
    - h. Cable shall withstand a bend radius of 1" at -20 degrees Celsius without jacket or insulation cracking.
    - i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
  2. Transmission Characteristics:
    - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
    - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 Nf.
    - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
    - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
  3. Acceptable products as follows:
    - a. Cable shall be Berk-Tek LANmark-10G2 UTP or approved equal.
    - b. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark-10G2 OSP (when used solely in wet location) or approved equal.
- C. 100 OHM Category 6A SHIELDED TWISTED PAIR CABLE (F/UTP)
1. Physical Characteristics:
    - a. Shall be plenum rated only and meet applicable requirements of ANSI/ICEA S-80-576. All 4 pairs must be insulated with F.E.P. No 2 x 2 or 3 x 1 constructions will be allowed.
    - b. The diameter of the insulated conductor shall be .023 in. maximum.
    - c. Shall consist of (4) twisted pairs.
    - d. Shall be suitable for the environment in which they are to be installed.
    - e. The color coding of pairs shall be per T-658B color coding scheme:  

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR
    - f. The overall diameter of the cable shall be no larger than 0.320" nominal.
    - g. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.

- h. Cable shall withstand a bend radius of 1" at -20 degrees Celsius without jacket or insulation cracking.
    - i. Cable shall be third party verified to meet ANSI/TIA/EIA-568-C.2.
  - 2. Transmission Characteristics:
    - a. DC resistance of any conductor shall not exceed 9.38 Ohms per 100m max. at 20°C. Measured in accordance with ASTM D 4566.
    - b. The mutual capacitance of any pair at 1 kHz for 100m of cable shall not exceed 4.4 Nf.
    - c. DC resistance unbalance between any two conductors of any pair shall not exceed 3% when measured at or corrected to 20°C in accordance with ASTM D 4566.
    - d. The capacitance unbalance to ground at 1 kHz of any pair shall not exceed 330 pF per 100m.
  - 3. Acceptable products as follows:
    - a. Cable shall be Berk-Tek LANmark-MD751 Cat 6A FTP solid CMR-CMX Outdoor rated with PVC jacket.

## 2.7 FIBER OPTIC CABLE

- A. Plenum Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 9/125um Optical Fibers
- B. SINGLEMODE FIBER: Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube with Laser Enhanced 9/125 Optical Fibers
  - 1. Each Singlemode Fiber shall be:
    - a. Graded-index optical fiber wave-guide with nominal 9/125um-core/cladding diameter, OS2 or better industry rating.
    - b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-4920000.
    - c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.
    - d. Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455—204.
    - e. The measurements shall be performed at 23 degrees C +/- 5 degrees.
    - f. Maximum attenuation dB/Km @ 1310/1550 nm: 0.4/0.3.
    - g. Optical Fiber shall be laser optimized and guarantee Gigabit Ethernet distances of >5000m for 1310nm and 10 Gigabit Ethernet distances of >5000m for 1310nm.
  - 2. Physical Characteristics:
    - a. Shall be suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance.
    - b. Shall be suitable for use in risers, plenums and horizontal applications.
    - c. Shall have a dry water blocking system for cable core and buffer tubes.
    - d. Shall be available with a fiber strand count range from 6 to 72.
    - e. Shall have a 3.0 mm sub-unit diameter.
    - f. Shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating.
    - g. Shall comply with the requirements of ICEA S-83-596 & ANSI/ICEA S-87-640.
    - h. Strength members shall be dielectric and may be either fiberglass or aramid yarn.
    - i. Suitable for underground or aboveground conduits.
    - j. Loose Tube fibers shall be color coded in accordance with EIA / TIA 598 with an overall dark blue jacket.
    - k. Shall have a ripcord for overall jacket.
    - l. Suitable for operation between -40° to +75° C.

- m. Shall be UV resistant.
  - n. Shall be of an all dielectric design.
  - o. Shall have a maximum installation tension of 300 lbs for cables without dielectric strength member and 600 lbs for cables with dielectric strength members.
3. Design Make:
- a. Berk-Tek "Adventum" OS2 optical fiber cable (Singlemode-AB) with 9/125 micron fiber or approved equal

## 2.8 FIBER OPTIC CONNECTORS

### A. LC Fiber Optic Connectors

- 1. Each LC Fiber Connector shall:
  - a. Be a pre-polished fiber connector with a fiber stub or field-polish fiber connector.
  - b. Be available in single mode and multimode versions.
  - c. Have a domed zirconia ferrule.
  - d. Be a PC polish type connector.
  - e. Accept a nominal fiber diameter of 125 micrometers.
  - f. Have a typical insertion loss of 0.1 dB for multimode and 0.1 dB for single mode.
  - g. Have repairable tips.
  - h. Have an insertion loss change of less than 0.2 dB after 500 reconnects.
  - i. Be stable over an operating range of -40C to +75 degrees C.
- 2. Design Make:
  - a. Leviton LC Fiber Optic Connectors on pre-terminated pig-tails or approved equal.
  - b. Fiber optic pigtails shall be fusion spliced only in submitted and approved fiber optic splice trays and enclosures.

## 2.9 COPPER CABLE PROTECTION UNITS

- A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the TC ground point. Approved manufacturer of protection units is Porta Systems.

## 2.10 PATCH CORDS

- A. The contractor shall provide factory terminated and tested UTP and optical fiber patch cords and equipment cords for the complete cabling system. The UTP patch cables shall meet the requirements of ANSI/TIA/EIA-568-B for patch cord testing.
- B. Copper (UTP) patch cords shall:
- 1. Use 8-position connector with impedance matched contacts and designed using dual reactance.
  - 2. Be constructed of 100 ohm, 4 pair stranded conductor, unshielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
  - 3. Meet TIA category 6A component specifications in ANSI/TIA/EIA-568-B.2-1
  - 4. 100% factory tested to meet category 6A performance and
  - 5. ETL or any other nationally recognized 3<sup>rd</sup> party verification

6. Be center tuned to category 6A performance specifications by using paired bi-level contact array.
7. Be capable of universal T568A or T568B wiring schemes.
8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have “snagless” protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
12. Be available in three standard colors.
13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
14. Be backwards compatible to Category 3, 5, 5e, and 6.
15. Be manufactured by an ISO 9001 registered company.

C. Copper (F/UTP) patch cords shall:

1. Use 8-position connector with impedance matched contacts and designed using dual reactance, with a foil shield encompassing the circumference of the cable, along the entire cable length.
2. Be constructed of 100 ohm, 4 pair stranded conductor, shielded twisted pair copper per the requirements of the ANSI/TIA/EIA-568-B.2 and ANSI/TIA/EIA-568-B.2-1 standard.
3. Meet TIA category 6A component specifications in ANSI/TIA/EIA-568-B.2-1
4. 100% factory tested to meet category 6A performance
5. ETL or any other nationally recognized 3<sup>rd</sup> party verification
6. Be center tuned to category 6A performance specifications by using paired bi-level contact array.
7. Be capable of universal T568A or T568B wiring schemes.
8. Modular connector shall maintain the paired construction of the cable to facilitate minimum untwisting of the wires.
9. Have a performance marking indelibly labeled on the jacket (by the manufacturer).
10. Have the ability to accept color-coded labels and icons to comply with ANSI/TIA/EIA-606-A labeling specifications.
11. Have “snagless” protection for the locking tab to prevent snagging and to protect locking tab in tight locations and provide bend relief.
12. Be available in three standard colors.
13. Be available in 3 foot, 5 foot, 7 foot, 9 foot, and 15 foot standard lengths.
14. Be backwards compatible to Category 3, 5, 5e, and 6.
15. Be manufactured by an ISO 9001 registered company
16. Be compatible for use with A/V system as submitted and approved
17. When installed below-grade, shall be OSP listed

D. Optical Fiber patch cords shall:

1. Contain two (2) multi-mode or single-mode optical fibers as shown on contract documents.
2. Use graded-index fibers with a 50 micron or 9 micron core (multimode or singlemode, respectively).
3. Be capable of transmission at both 850 nm and 1300 nm wavelengths for multimode, and 1310nm and 1550nm wavelengths for singlemode.
4. Include listing of actual loss of patchcord when packaged.
5. Be manufactured in standard lengths of 1 m (3.27 ft), 2 m (6.56 ft), 3 m (9.84 ft), 4 m (13.11 ft), 7 m (22.95 ft), and 10 m (32.79 ft), and special ordered in any other lengths.

6. Be manufactured by an ISO 9001 registered company.

## 2.11 GROUNDING AND BONDING

- A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607 Telecommunications Bonding and Grounding Standard.
- B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.
- C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, ungrounded conduits, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
- D. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

## 2.12 FIRESTOP

- A. A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
- B. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

## PART 3 - EXECUTION

## 3.1 WORK AREA OUTLETS

- A. Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 12" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.0 document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 12 mm (one-half inch).
- D. Bend radius of the horizontal cable shall not be less than 4 times the outside diameter of the UTP cable.
- E. The cable jacket shall be maintained to within 25mm (one inch) of the termination point.
- F. Voice/Data jacks, also known as telecommunications jacks, for the purposes of this building are to be installed as all data, in conformance with all Category 6A standards for component and channel ratings. Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate, populated from left-to-right and top-to-bottom in the faceplate.
- G. Where (4) or fewer data jacks are specified, contractor shall install a 4-port faceplate with blank covers (with color to match faceplate) in unused modular jack openings.

## 3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

- A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.
- C. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- D. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
- E. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- F. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.
- G. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.



- H. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
- I. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- J. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- K. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
- L. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- M. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- N. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
- O. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.
- P. Cables installed underground or below slab shall be suitable for use in wet locations and outdoors in duct or conduit. If wet location cable is exposed in the building after exiting the wet area, it must transition to an appropriate category dry cable within 50 feet (15M) of exiting conduit.
- Q. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).
- R. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- S. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- T. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.
- U. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

### 3.3 OPTICAL FIBER TERMINATION HARDWARE

- A. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.
- B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.
- C. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.
- D. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.
- E. A maximum of 12 strands of fiber shall be spliced in each tray.
- F. All spare strands shall be installed into spare splice trays.

### 3.4 BACKBONE CABLE INSTALLATION

- A. Backbone cables shall be installed separately from horizontal distribution cables
- B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- C. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits
- D. Where backbone cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.
- E. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
- F. All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- G. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- H. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- I. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

### 3.5 RACKS

- A. Racks shall be securely attached to the concrete floor using a minimum 5/8" hardware or as required by local codes. In no case shall the racks be secured by means any less than the requirements as detailed on the Structural or Electrical drawings.
- B. Racks shall be placed with a minimum of 36-inch clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
- C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 3.9 of this document.
- D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- E. Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.
- F. Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

### 3.6 FIRESTOP SYSTEM

- A. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

### 3.7 GROUNDING SYSTEM

- A. The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the ANSI/TIA/EIA-607 standard, and shall be installed in accordance with best industry practice.
- B. Installation and termination of the main bonding conductor to the building service entrance ground shall be performed by a licensed electrical contractor.

### 3.8 IDENTIFICATION AND LABELING

- A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall follow the guidelines of ANSI/TIA/EIA-606-A.

- B. Outside Plant cables passing through a pull box or vault shall have a cable label that is water and mud proof.
- C. All label printing will be machine generated by Ortronics LabelMo, or similar software, using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

### 3.9 TESTING AND ACCEPTANCE

#### A. General

- 1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.
- 2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Certification Program Information Manual provided by the product manufacturer and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

#### B. Copper Link Testing

- 1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance.
- 2. Horizontal cabling shall be tested using a Level III test unit for category 6 performance compliance.
- 3. The basic tests required are:
  - a. Wire Map
  - b. Length
  - c. Attenuation
  - d. NEXT (Near end crosstalk)
  - e. Return Loss
  - f. ELFEXT Loss
  - g. Propagation Delay
  - h. Delay skew
  - i. PSNEXT (Power sum near-end crosstalk loss)
  - j. PSELFEXT (Power sum equal level far-end crosstalk loss)
- 4. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

5. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
6. Category 6A performance shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

Frequency (MHz)	Maximum Insertion Loss (dB)	Minimum NEXT (dB)	Minimum PSNEXT (dB)	Minimum ELFEXT (dB)	Minimum PSELFEXT (dB)	Minimum Return Loss (dB)
1.0	2.1	74.3	72.3	-	-	20.0
4.0	3.8	65.3	63.3	-	-	23.0
10.0	5.9	59.3	57.3	-	-	25.0
16.0	7.5	56.2	54.2	-	-	25.0
20.0	8.4	54.8	52.8	-	-	25.0
31.25	10.5	51.9	49.0	-	-	23.6
62.5	15.0	47.4	45.4	-	-	21.5
100.0	19.1	44.3	42.3	-	-	20.1
250.0	31.1	38.3	36.3	-	-	17.3
350.0	37.2	36.1	34.1	-	-	16.3
400.0	40.1	35.3	33.3	-	-	15.9
500.0	45.3	33.8	31.8	-	-	15.2

NOTE: For ELFEXT and PSELFEXT, follow TIA guidelines for Cat6A

#### C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of an end-to-end power meter test performed per EIA/TIA-455-53A. The system loss measurements shall be provided at 850 and/or 1300 nanometers for multimode fibers and 1310 and/or 1550 nanometers for single mode fibers. These tests also include continuity checking of each fiber.
2. Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for singlemode) in both directions.
3. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
4. Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **ONLY LINK TEST IS REQUIRED.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.
5. Attenuation testing shall be performed with an approved hand held tester from an industry recognized test equipment manufacturer.

#### D. Additional 3<sup>rd</sup> Party Fiber Optic and UTP (Copper Link) Testing

1. Due to the initial/immediate network implementation of 40-100Gbps fiber Ethernet topologies and multi-Gigabit Ethernet UTP technologies with up to Class 8 PoE, the

Owner, at the Owner's own expense, will be performing additional independent third-party testing of all fiber and UTP cabling. The fiber optic testing, in particular, will include independent third-party end-face inspection with certification, bidirectional Tier-1, and averaged-bidirectional Tier-2 fiber testing for every strand of the new permanent fiber optic cabling installed within this project. This additional testing will allow the IT department to certify the cabling performance for the required network application topologies, before equipment installation and provisioning, with testing criteria and procedures that may exceed the requirements described within these construction documents.

2. While the additional aforementioned third-party testing is independent and outside of this contract, the fiber optic and UTP test results provided from both parties will be compared directly against each other for additional Owner confirmation of the new cabling's suitability for use.
3. On projects involving Contractor racking, stacking, and patching (RSP) of Owner provided network electronics, Contractor RSP work shall not be started until all fiber optic and UTP tests within the respective telecom room have been reviewed and accepted by the Owner in writing.
4. The Contractor shall submit all fiber optic and UTP testing results as LinkWare PC native source output (.flw file extension). The Owner will not accept PDF results. All other contractor requirements defined within the project scope of work shall remain in place.

### 3.10 NETWORK INTEGRATION

1. Contractor shall perform network integration and physical installation of owner provided and contractor provided active electronics and associated patch cabling. No network integration work shall commence prior to the following prerequisites:
  - a. Owner approval of all fiber and UTP test reports indicating suitability for use of installed cabling infrastructure.
  - b. On-site coordination meeting to review installation details
2. Integration work will include tasks that will prepare systems for owner commissioning:
  - a. Physical installation of network electronics (owner furnished)
  - b. Physical installation of UTP patch cords from premises cabling systems to network electronics (contractor provided patch cabling)
  - c. Physical installation, testing, and commissioning of UPS and PDU power delivery equipments within the telecom rooms (contractor furnished)
  - d. Physical installation of IP cameras including required patch cabling (contractor furnished)
  - e. Physical installation of Wireless Access Points including required patch cabling (WAPs are owner furnished, contractor installed including patch cords).
3. Prior to owner configuration and commissioning of network systems, contractor shall provide as-built drawings and schedules of integration work performed. Details and formats to be reviewed during the pre-integration coordination meeting and will include, but may not be limited to the following items:
  - a. Patching schedule detailing all UTP premises cabling to network switch ports
  - b. Equipment schedules including all devices with their serial numbers, MAC addresses, and the cable identification(s) supporting the device.
  - c. As-built drawings including the locations of all installed devices with serial numbers, MAC addresses, and the cable identification(s) supporting the device.

### 3.11 SYSTEM DOCUMENTATION

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase (e.g. subsystem, cable type, area, floor, etc.). This is inclusive of all test result and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

### 3.12 TEST RESULTS

- A. Test documentation shall be provided on disk within three weeks after the completion of the project. The disk shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- B. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C including applicable TSB's and amendments. The appropriate Level III tester shall be used to verify Category 6A cabling systems.
- C. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The telecommunications contractor must furnish this information in electronic form CD-ROM). If needed, provide manufacturers software require to read the test results.
- D. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

## PART 4 - WARRANTY AND SERVICES

### 4.1 WARRANTY

- A. The manufacturer shall provide the warranty directly to the end-user.
- B. An Extended Product Warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of registration. The Extended Product Warranty shall warrant the installed horizontal and/or backbone copper, and both the horizontal and the backbone optical fiber portions of the cabling system as applicable for the cabling manufacturer.
- C. The Application Assurance Warranty shall cover the failure of the wiring system to support the applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.0. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 155Mb/sATM, and 1Gb/s ATM.
- D. The contractor shall provide a warranty on the physical installation.

### 4.2 FINAL ACCEPTANCE AND SYSTEM CERTIFICATION

- A. Completion of the installation, in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the cabling system for a two-week period will constitute acceptance of the system. Upon successful completion of the installation and subsequent inspection, the end user shall be provided with a numbered certificate, from the product manufacturer, registering the installation.

END OF SECTION



## SECTION 28 13 00 - ELECTRONIC ACCESS CONTROL

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. The work consists of providing and installing prescribed systems and equipment, in accordance with the Owner's directives and needs. The Contractor shall design, install, and configure systems to provide the exact function described herein and will be held to the operational criteria. Contractor shall be responsible for providing and installing a complete and fully operational system, with the intended features and capabilities, whether or not all required parts, components, systems or accessories are specified in the construction documents. Contractor shall provide all required parts, components, systems, materials and accessories needed for a complete and working system, without additional cost to the owner.
- B. Furnish all labor, materials, tools, equipment, and services for all Access Control Equipment, as indicated, in accord with provisions of Contract Documents. Final terminations and system commissioning to be performed by a factory certified technician. Systems and the respective specification sections which are part of this section include but are not limited to the following:
  - 1. Reader Controller
  - 2. Reader Interface
  - 3. Power Supply
  - 4. Card Readers / Keypads
  - 5. Wiring, switches and ancillary equipment
- C. Although such work is not specifically indicated, provide and install supplementary or miscellaneous items, appurtenances and devices incidental to, or necessary for, a sound, secure and complete installation.
- D. Training on operation and software of the access control system per Section 3.2 of this specification section.

## 1.2 INTENT OF ACCESS CONTROL SPECIFICATION

- A. The following specification shall be considered as coordinated with the general conditions, special conditions and the preamble of this and other related sections. It shall be the Security Contractor's responsibility to furnish all necessary systems and equipment, in accordance with the Owner's directives and needs.
- B. Where items aren't definitely or correctly specified and are required for completion of the work, a written statement of such omission, error, or other discrepancy shall be sent to the Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.
- C. Adjustments to the Contract Sum will not be allowed for omissions not clarified prior to bid opening.

## 1.3 QUALITY ASSURANCE

## A. Requirements of Regulatory Agencies:

1. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
2. Furnish security equipment to comply with the requirements of American National Standards for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (ICC/ANSI A117.1), the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.
3. System supplier must be certified by owner's selected manufacturer, the equipment manufacturer, for installing, supporting and servicing the products to be furnished. Certification shall be submitted on the equipment manufacturer's letterhead, at product submittal timeframe.

## B. Contractor qualifications:

1. Company that is trained, authorized, and certified to install the specified products.
2. Company with a minimum of 5 (five) years system design, engineering supervision, and installation experience in the access control industry.
3. The contractor will maintain a fully staffed local office within 150 miles of the work site. The service center will be staffed by factory trained technicians and must be adequately equipped to provide emergency phone service within twenty four (24) hours on a twenty-four (24) hour, 365 days per year basis, whether or not the owner purchases a maintenance contract with the contractor.
4. Within the local service center, the contractor must maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements.
5. The contractor must have in-house engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the Operation and Maintenance Manuals, Training Programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The owner reserves the right to approve the contractor's Project Manager.
6. The contractor must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

## C. Testing Agency: Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## D. Pre-Installation Conference: Prior to installation and rough-in arrange conference between supplier, and related trades to review materials, procedures, and coordinating related work.

## E. Sequencing: The work shall be performed in the following sequence, unless directed otherwise by owner's representative:

1. Installation of all conduit and rough-in boxes
2. Installation of wiring
3. Installation of Access Controllers, Modules & Power Supplies
4. Installation of new field devices and new readers/network locks

5. Connection to site control & front end equipment.
6. Commissioning of the new system components.
7. End User training

F. The Authorized Dealer will provide pricing for 1 year warranty from date of purchase.

#### 1.4 PROJECT SUMMARY

- A. These specifications describe the requirements, performance parameters, and operating considerations for the installation of electronic access control systems.
- B. The intent of this project will be to secure perimeter access doors/points using the access control readers and software by the owner's selected manufacturer.

#### 1.5 WARRANTY

- A. All work and system components shall be covered by a one (1) year 'in field' warranty against defects in materials and workmanship, commencing with substantial completion of the project, unless otherwise directed by owner or their representative.
- B. During system warranty period, system updates are to be made available to owner at no charge to owner.
- C. During warranty period, provide twenty-four (24) hour toll-free technical support.

#### 1.6 SUBMITTALS

- A. Under the provisions of this request for proposal, prior to the start of work the contractor shall:
  1. Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
  2. Submit proof from manufacturer of contractor's good standing in manufacturer's program.
  3. Submit appropriate cut sheets and samples for all products, hardware and cabling.
  4. Shop drawing of equipment connections, point-to-point diagrams, etc. sufficient to describe the operation of the system. Telecommunications Contractor shall include equipment listed by other trades and shall provide at submittal time.
- B. Work shall not proceed without the Owner's approval of the submitted items.
- C. The telecommunications contractor shall receive approval from the Owners on all substitutions of material. No substituted materials shall be installed except by written approval from the Owner.
- D. If a submittal is provided without shop drawings, an immediate "Revise and Re-submit" shall be issued back to Contractor.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Access Control System Hardware/Firmware/Software:
  - 1. Security Management System (SMS) as manufactured by Owner's preferred manufacturer. (No substitutions per District standard)

### 2.2 SYSTEM PROGRAMMING

- A. The contractor shall furnish and install all hardware, software, devices and components to meet the performance and functional requirements described in these contract documents. Include all items required, whether or not individually specified, to ensure a completely operational integrated Security Protection system. The contractor must complete all database entry (unless directed otherwise by owner or their representative), and provide the owner with training on cardholder entry, as well as all system programming. No additional costs shall be allowed to make the system operational or to meet specifications.

### 2.3 SYSTEM ARCHITECTURE

- A. System Description:
  - 1. Primary function is to regulate access through specific portals to Secured areas.
  - 2. Utilize card technology as its primary access device.
  - 3. Surge Protection Components must be protected from voltage surges originating externally to equipment housing and entering through power, communication, signal, control, or sensing leads. Must also include surge protection for external wiring of each conductor-entry connection to components.
  - 4. Power: Any special power treatment required, such as filtering or spike elimination that may be required for proper operation and protection of the ACS, shall be provided with the system. Step down power supply with battery backup of at least 4 hours.

### 2.4 SYSTEM HARDWARE

- A. Access Control System Hardware/Firmware/Software:
  - 1. As manufactured by owner's preferred manufacturer. No substitutions per District standard
- B. Credentials & Readers:
  - 1. As manufactured by owner's preferred manufacturer, No substitutions
    - a. Mullion and Switchmount parts shall be acceptable based upon specific mounting conditions of device at door/access location.
- C. Door Position Switches/Contacts:
  - 1. Refer to Door Hardware specifications (No substitutions)
- D. Request-to-Exit Motion Sensors:
  - 1. As manufactured by owner's preferred manufacturer, No substitutions

- E. Power Supplies:
  - 1. As manufactured by owner's preferred manufacturer.

### PART 3 - EXECUTION

#### 3.1 SYSTEM PROGRAMMING

- A. The Contractor shall work with the owner to ensure that the new components will be properly programmed into the new and/or existing system.
- B. Coordination required is as follows, unless directed otherwise by owner or their representative;
  - 1. Personal/staff information.
  - 2. Access time for all personal /staff.
  - 3. Definitions of openings for staff access.
  - 4. Holiday definition
  - 5. Special access privileges
  - 6. Lock down conditions

#### 3.2 SYSTEM INSTALLATION

- A. System shall tie into existing campus access control head-end unit/system. EC shall work with owner to identify and extend existing campus access control system and appropriately tie new and existing together. EC shall provide and install all applicable components, including but not limited to, cables, patch panels, connectors, conduit, etc. for a fully functioning system.
- B. EC shall provide a minimum of 250 wireless access keycard/fob to District at completion of project. Keycards/fobs shall be compatible with owner's preferred manufacturer system, and shall be coordinated such that new keycards/fobs do not re-use or otherwise overlap with existing credential numbering system (credentials shall be unique).

#### 3.3 OWNER PERSONNEL TRAINING

- A. On Site Operator training: instruct operating staff in proper operation, including hands-on training.
- B. Minimum of four (4), man-hours covering the operations for each system installed.
- C. Training sessions shall be provided to supervisors, staff utilizing systems and equipment provided under this section, maintenance personnel and any other personnel designated by the owner. Security Contractor should prepare to provide operator training for up to ten (10) personnel.
- D. Security contractor shall be prepared to provide training sessions on all work shifts, including day, evening and night shifts.
- E. On Site Administrator training: instruct owner-designated security system administrators for each system installed.

- F. Minimum of four (4), man-hours of training for each owner-designated individual.
- G. Training to cover all administrative and management functions, features and controls for each system.
- H. Refresher training: provide a 90-day refresher training session to operators and administrators.
- I. Minimum of four (4) hours of training for each owner-designated Operator and/or Administrator.
- J. Training shall cover summaries of all operator and administrator training topics and shall include greater detail on subject areas or operations not yet mastered by operators or administrators.
- K. Review in detail all information in the operations and maintenance manuals for each system provided.
- L. Prior to administering the above training, the contractor(s) shall prepare an outline of the training, identifying the goals and expectations of the course and detailing what students are expected to learn.
- M. Training courses shall be videotaped for subsequent training use by the Owner.

END OF SECTION

## SECTION 28 31 00 - FIRE ALARM AND DETECTION SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section Includes:

1. Provide a fully addressable, power limited, fire detection and evacuation system for the project building that is connected to the Campus Fire Alarm System Network. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. Substitution of system components or manufacturer will require the contractor to separately obtain approval with the CSFM at Contractor's expense and shall meet all requirements of the system as designed and pre-approved. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 5 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72-7-1.
6. Warranty: The equipment and wiring shall be warranted to be free from electrical and mechanical defects for a period of two (2) years commencing with final acceptance by Owner.
7. All Fire Alarm wiring shown in drawings shall be installed in conduit.
8. System Operation shall include:
  - a. Separate zone signaling and device status indication for all initiating devices.

- b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10' or more than 120dBA.
  - c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
  - d. Supervision of all circuits to indicate any abnormal wiring condition.
  - e. One (1) N.O./N.C. integral relay for external device interface or as indicated on drawings.
  - f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.
9. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
- a. Life safety fire alarm detection and signaling system.
  - b. Furnishing and installation of equipment and devices.
  - c. Conductors, connections and interconnections where specified and all in conduit system.
  - d. Conduit, wire and connections for control of heating and ventilation motors, smoke dampers and smoke exhaust.
  - e. Testing, cleaning and adjusting of completed work.
  - f. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
  - g. Complete maintenance for two years. Proposal for subsequent maintenance contract.
  - h. All work and material for complete and operable systems as indicated or specified.
  - i. Permits, inspections and fees.
  - j. Identification and instruction to Owner Representative. Training shall consist of a minimum of two (2) 6-hour sessions.
10. Coordination with Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
11. Furnishing of special back boxes where required for installation of fire alarm devices.
12. Mechanical system duct detectors shall interface with fire alarm system without additional or special control devices.
13. All conductors to be installed in conduit pursuant to Specification Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
14. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
15. All initiating devices shall be separately addressed for individual identification at control panel.
16. As-Built Drawings: A complete set of reproducible "as-built" drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
17. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
- a. Instructions for replacing any components of the system, including internal parts.
  - b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.



- c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
- d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.

### 1.3 SUBMITTALS

- A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
- B. The submittal shall include certification from the manufacturer verifying that the distributor is an authorized agent, who is qualified and trained by the manufacturer in the proper installation, operation and service of the system.
- C. Shop Drawings:
  - 1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component and CSFM number.
  - 2. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed.
  - 3. Include wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
  - 4. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
  - 5. Describe system characteristics and function as well as device wiring diagrams.
  - 6. Voltage drop and battery calculations for each control panel and power supply and initiating circuits.
  - 7. System operational matrix.
- D. Data Sheets: Show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.
- E. Manufacturer's Certificate: Note whether the system meets or exceeds specified requirements.
- F. Operating and Maintenance Instruction Manual:
  - 1. Manual shall include the following tailored to this specific project:
    - a. Operational description.
    - b. Coded cabling plan.
    - c. Two wire circuit diagrams.
    - d. Wiring destination schedule.
    - e. Schematic component diagrams and PC board layouts.
    - f. Maintenance and alignment procedures.
    - g. Voltage drop and battery calculations.

#### 1.4 COORDINATION

- A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit proposed interconnection to elevator supplier. Submit conduit and pathing requirements to electrical installer. For self-contained door release, coordinate with door supplier.

#### 1.5 SYSTEM DESCRIPTION

- A. General: System to be listed by Underwriters Laboratories and the California State Fire Marshal, designed to meet the functional requirements of NFPA 72A, 72B and 72D.
- B. Features:
  - 1. Building fire control Panel with Fiber Optic interface connection to Campus Main Fire Alarm System with alarm communicator transmitter (DACT).
  - 2. Remote annunciator(s) as specified.
  - 3. Alarm/trouble point transmitters.
  - 4. Manual alarm reporting stations (addressable).
  - 5. Ionization smoke detectors (addressable).
  - 6. Fan duct smoke detectors (addressable).
  - 7. NAC extender panels.
  - 8. Heat detectors (addressable).
  - 9. Electromagnetic door hold open devices as required.
  - 10. Horn and audible devices.
  - 11. Visual alarm signal device.
  - 12. Exterior bell.
  - 13. Connection to sprinkler waterflow and pressure switches (addressable).
  - 14. Sprinkler valve supervision (addressable).
  - 15. Interface with the HVAC system for control of supply fans for all buildings. All required interface relays. Manual override control of motors and dampers at fire control panel.
  - 16. Interface with fire dampers for the release of fire dampers on fire alarm initiation.
  - 17. Control module.
  - 18. Monitor module.
  - 19. Sync. Module.

#### 1.6 SYSTEM OPERATION

- A. System to be the active interrogate/respond type alarm system, 24 volt DC noncoded, positive, non-interfering, successive operation, in which all devices are constantly sending status signals to the main fire control command center from remote data transmitter panels approximately every one second. A change in status to be reported twice to determine that it is a valid signal, and be automatically and permanently recorded.
- B. Wiring, equipment and devices for alarm initiation, annunciation, and audible signaling to be continuously supervised for opens, shorts or grounds (trouble). Each alarm initiating device circuit to be provided with illuminated and audible annunciation of both trouble and alarm conditions. Non-illumination indicates a normal condition.

- C. Any alarm or trouble condition shall sound an audible signal at the fire command center and the remote annunciator. Signal shall be silenced by a momentary contact switch which shall transfer the signal to a visual indicator. Subsequent trouble conditions shall cause the signal to resound and in turn may be silenced. Upon restoration to normal, the trouble signal silencing indicator shall extinguish automatically.
- D. Activation of any automatic or manual alarm initiating device shall cause the following to occur:
  - 1. Sound an audible alarm and illuminate the visual indicator for zone and type of alarm at the fire command center, the remote annunciator and fire alarm control panel.
  - 2. Sound, at building of origin, the audible alarm signal over the system audible devices and activate the visual signal devices.
  - 3. Transmit signal to release the electromagnetic hold open devices on corridor doors by floor.
  - 4. Transmit signal to close smoke dampers.
  - 5. Transmit alarm signal to energy management system for shutdown of building air handler.
  - 6. Transmit alarm signal to the central station office.
  - 7. Release exit door locks.
- E. System shall not incorporate a time delay for any of the alarm initiating devices. All alarms shall be considered confirmed alarms.
- F. Detection shall be addressable and reporting of fire conditions to be accomplished by the following basic methods:
  - 1. Manual stations.
  - 2. Smoke detectors.
  - 3. Heat detectors.
  - 4. Duct detectors.
  - 5. Waterflow switches.
- G. Fire alarm system inputs to be further subdivided as follows, for a more defined indication of the location and nature of the fire or trouble condition:
  - 1. Manual station by device and location.
  - 2. Smoke/heat detector by device and location.
  - 3. Waterflow or pressure switch by device and location.
  - 4. Sprinkler valve position indication by device and location.
- H. Alarm condition shall override trouble indication. Trouble indication shall reappear after alarm reset.
- I. Fire Alarm Zones shall be as indicated on drawings.
- J. Printout on system printer of all alarm and trouble reports, indicating type of device, condition, time and date and alarm clearing.
- K. Selective manual testing of any device point or zone in the system to determine normal, trouble or alarm status.
- L. Command center shall have annunciator indicating building floor, room number and zone.

- M. Remote annunciators to duplicate annunciation from the main fire control command center.
- N. System shall be capable of manual operation in the event of malfunction of the central processor. Supplier shall include a statement in the system shop drawing submittal explaining the manual operating capability of the system. System shall provide redundant processor capabilities to duplicate primary processor function.
- O. HVAC Interface: Coordinate system function with mechanical contractor for programmable shutdown of building air handlers.
- P. Operation: All components shall be interconnected in accordance with the manufacturer's instructions to provide a complete and operable system as described.

#### 1.7 LOADS OF EQUIPMENT AND COMPONENTS

- A. Follow IEEE Standard where applicable.
- B. Provide fuse protection for equipment and spare fuses.
- C. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.
- D. Operating voltage dissipated by resistors shall not exceed 25% of ratings.
- E. Operating voltage of capacitors shall not exceed 80% of rated voltage.
- F. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.
- G. Use electronic components of types and rating commonly available from stock of established commercial distribution.

#### 1.8 GUARANTEE

- A. Conform to applicable provisions of the GENERAL REQUIREMENTS.
- B. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.
- C. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.
- D. All component failures shall be remedied to the satisfaction of the Owner.

- E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

## PART 2 - PRODUCT

### 2.1 MATERIALS

- A. Fire Alarm Control Panel (FACP) and system shall be UL listed for power-limited application, (as described on the plans). The system shall be as manufactured by Gamewell- FCI (Fire Control Instruments) or approved alternate.
- B. Peripheral Devices
  - 1. Analog Photoelectric Smoke Sensors (refer to drawings for model number).
    - a. Analog photoelectric sensors shall have a low profile and be capable of being set at five sensitivity settings of “LOW, LOW MEDIUM, MEDIUM, MEDIUM HIGH, and HIGH” levels.
    - b. Automatic and manual functional sensitivity and performance tests shall be possible without the need for generating smoke. This method shall test all sensor circuitry and a “Failed Test” indication shall display for any failed test.
    - c. Two LEDs providing 360-degree visibility of operating status and alarm indication shall be provided on each sensor. The LEDs shall pulse periodically indicating that the sensor is receiving power and communication is taking place. This feature shall be field programmable. Upon alarm, these LEDs shall light continuously. An alarm output shall be available for remote annunciation.
    - d. The system shall check the sensitivity of each sensor periodically. If a sensor alarm threshold sensitivity has changed, due to again and/or dust accumulation, the system shall automatically compensate for this change (drift compensation).
    - e. Each sensor shall allow for the setting of two sensitivity levels. These levels may be programmed so that when the building is occupied, a sensor will be less sensitive than when the building is unoccupied. This feature permits sensors to be more reliable and at the same time reduces/minimizes unwanted alarms. This feature shall also provide for programmable weekend days, where the sensor will remain at an unoccupied sensitivity level.
    - f. The sensor screen and cover assembly shall be removable for field cleaning.
  - 2. Addressable Thermal Sensor (refer to drawings for model number):
    - a. Addressable thermal sensors shall have a low-profile and operate on the combination “rate-of-rise” and “fixed temperature” principals with the fixed temperature set point at 135°F. They shall contain dual thermistor sensing circuitry for fast response.
  - 3. Addressable Subloop Monitor Module (refer to drawings for model number):
    - a. An addressable monitor module with an initiating circuit capable of being configured Class B, Style B. The module shall contain a yellow status LED that shall flash when in a quiescent mode and light continuously when in alarm. The LED shall be field programmable not to provide quiescent status indication, if so desired.
  - 4. Manual Fire Alarm Station: Double Action Manual Station (refer to drawings for model number):
    - a. Furnish and install a manual station as indicated. Each station shall be of the addressable double action type, requiring an outer door to be lifted to expose the

- actuator door. Upon pulling forward of the actuator door, the unit shall lock into a readily observable "alarm" position.
5. Duct Smoke Detectors (refer to drawings for model number):
    - a. The contractor shall furnish and install where shown on plans photoelectric or ionization duct smoke detectors wired in a two-wire configuration. The detectors shall be UL Listed under UL Standard 268A for duct smoke detectors and allow remote functional testing without generating smoke.
  - C. Fire Alarm remote power supply, NAC panel, shall be UL listed for power-limited application. Provided with (4) four-signal circuits minimum capacity or as required to make system fully operational with an output current of 6 to 9 amps as required for proper operation.
  - D. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing:
  - E. Fire Alarm terminal cabinet shall be Square D Class 6650. Size as shown on drawings or as required.
  - F. Substitutions
    1. The fire alarm System has been designed and approved as a "complete system". Substitute equipment will be approved when the following conditions are met:
      - a. A request for substitution shall be made prior to bid for the Owner's and design team consideration and approval.
      - b. Submit detailed fire alarm plans, specifications and engineering calculations including but not necessarily limited to:
        - 1) CSFM listing #'s and Manufacturer Model #'s for every system component which is to be interconnected as a part of this project.
    2. Single line, riser and point to point wiring diagrams including battery and voltage drop calculations for the entire system in compliance with NFPA 72. Indicating appliance shall be calculated on the bases of the highest current rating possible at that device.
    3. Indication of conductor type(s), power-limited or non-power-limited system, independent of interconnected to existing system.
    4. Submit / obtain approval from the Owner for the entire system.
      - a. The party requesting the substitution shall be responsible for any additional cost acquired during the approval.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with all applicable paragraphs in Section 260500, COMMON WORK RESULTS FOR ELECTRICAL, apply as though repeated herein.
- B. Install system(s) in accordance with manufacturer's instructions.
- C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative.

### 3.2 GROUNDING

- A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 0526, GROUNDING AND BONDING OF ELECTRICAL SYSTEMS.

### 3.3 INSPECTION

- A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.

### 3.4 LOCATION

- A. Before installation, verify exact location of control equipment and outlets. The Owner reserves the right to relocate system components within a radius of 10' at no increase in cost before rough-in work is started for the respective component.

### 3.5 WIRING

- A. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.

### 3.6 TESTING

- A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies.
  - 1. The contractor's job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
  - 2. At least on half of all tests shall be performed on battery standby power.
  - 3. Where application of heat would destroy any detector, it may be manually activated.
  - 4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
  - 5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
  - 6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.

7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

### 3.7 REPORT

- A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION



## SECTION 31 11 00 - SITE CLEARING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY:

- A. This Section includes the following:

- 1. Provide all material, labor, equipment and services necessary to completely clear and demolish all materials, accessories and other related items necessary to complete the Project as indicated by the Contract Documents.

- B. RELATED SECTIONS:

- 1. Contract General Conditions and Division 01, General Requirements
  - 2. Section 31 20 00 – Earthwork: Excavation, Filling, and Grading
  - 3. Section 31 22 22 – Soil Materials
  - 4. Section 31 23 33 – Trench Excavation and Backfill

## 1.3 SUBMITTALS

(NOT APPLICABLE)

## 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:

- 1. In accordance with Specification Section GENERAL REQUIREMENTS, and the following:
    - a. Materials and equipment used for this project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].

- B. Meetings:

- 1. Minimum agenda shall be to discuss coordination of upcoming work, review the work progress, discuss field observations, identification of any potential problems which may impede planned progress; corrective measures to regain projected schedule; and maintenance of quality and work standards.
  - 2. Meetings shall include Pre-Clearing and Demolition Meetings.

3. Participants (or designated representative of) invited to attend each of the above meetings shall be as follows:
  - a. Contractor.
  - b. Owner.
  - c. Architect.
  - d. Testing Laboratory.
  - e. Local Governing Authorities as applicable.
  - f. Utility Representatives as applicable.
  - g. Owner's Inspector.
  - h. Clearing and Demolition Subcontractor.
  - i. Other subcontractors, as appropriate (including any accessory subcontractors).

#### 1.5 PROJECT CONDITIONS OR SITE CONDITIONS

##### A. Dust Control

1. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
2. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
3. No construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan, if one is required.
4. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.
5. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefor.

##### B. Existing Conditions:

1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives, walks or occupied facilities.
  - a. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and Authorities having jurisdiction.
  - b. Provide alternate routes around closed or obstructed traffic ways if required by Authorities having jurisdiction.

3. Locate and identify utilities.
  - a. Call a Local Utility Locator Service (USA – “Underground Service Alert” – [800] 227-2600) for the task of locating any applicable utilities in the area where the Project is located.
4. Carefully remove items indicated to be salvaged and store on Owner’s premises at the Owner’s direction.

## PART 2 - PRODUCTS

(NOT APPLICABLE)

## PART 3 - EXECUTION

### 3.1 PREPARATION

#### A. Coordination:

1. Coordinate work under this specification section with work specified under other sections to ensure proper and adequate interface of work.

#### B. Protection:

1. Protect and maintain all benchmarks and survey control points from disturbance during clearing and demolition operations.
2. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties.
3. Furnish and install temporary protection/barrier fencing surrounding the limits of demolition.
4. Protect trees, plant growth, and features not specifically designated for removal. Locate and clearly flag trees and vegetation to remain or to be relocated.
5. Protect existing improvements designated to remain from damage during construction.
  - a. Restore damaged improvements to their original condition, as acceptable to the Owner.

### 3.2 CONSTRUCTION

#### A. Shrub and Weed Removal:

1. Remove weeds and rooted topsoil to a minimum four (4) inch depth and temporarily stockpile as needed for re-use in finished grading of landscape areas. Remove excess material from the site.
2. Where existing vegetation is to be replaced by new materials, remove contaminated or excess soil from the site and legally dispose of off-site.

B. Existing Site Improvements Removal:

1. Remove existing above and below grade improvements as necessary to facilitate new construction.
  - a. Remove concrete slabs, sidewalk, curbs, mow strips, gutters, and fence post footings.
    - 1) Neatly saw-cut length of existing pavement to remain before removing existing pavement unless existing full-depth joints coincide with line of demolition. Saw-cut faces vertically.
  - b. Remove indicated utility improvements within the limits of construction.
    - 1) Excavate for and disconnect utilities designated to be removed. Seal or cap off underground.
    - 2) Coordinate removal and/or relocation of utilities with the appropriate utility agencies.
  - c. Where existing underground utilities, irrigation pipes, wells, leach fields, or underground tanks are encountered, they must be removed or moved to a point at least 5 feet horizontally outside the proposed building and 3 feet horizontally outside the concrete flatwork or pavement construction areas. All resultant cavities must be backfilled with engineered fill.
  - d. Remove concrete slabs, foundations, and utilities within building footprint.

C. Existing Utilities to Remain or be Relocated:

1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - a. Notify Architect and the Owner not less than seven (7) days in advance of proposed utility interruptions.
  - b. Arrange to shut off indicated utilities with utility companies and Owner.

D. Disposal:

1. Legally dispose of all debris (surplus soil materials, unsuitable topsoil, obstructions, demolished materials, waste materials, trash, etc.) resulting from clearing, grubbing, demolition and from construction. Disposal of all materials shall be at a location secured by the Contractor off of the Owner's property.

END OF SECTION

SECTION 312000 - EARTHWORK: EXCAVATION, FILLING AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. This Section includes the following:
  - 1. Excavating soil and other material for surface improvements.
  - 2. Placing fill.
  - 3. Compaction of existing ground and fill.
  - 4. Preparation of subgrade for other improvements.
  - 5. Grading of soil.
- B. RELATED SECTIONS
  - 1. Contract General Conditions and Division 1, General Requirements
  - 2. Section 31 11 00 – Site Clearing
  - 3. Section 31 22 22 – Soil Materials
  - 4. Section 31 23 33 – Trench Excavation and Backfill

1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.
- B. A Geotechnical Engineering Investigation Report has been prepared for the project by TECHNICON Engineering Services, Inc. TECHNICON Project No. 240005.001, dated March, 15, 2024. A copy of the report is available (for reference only) at the cost of reproduction. Contact TECHNICON Engineering Services, Inc. if a copy of the report is desired.

1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

A. Product Data:

1. Information indicating the source of all import material, the fill material type and where it is to be used, and approval of the District's Inspector of Record for incorporation of import material into the Work.

B. Material Test Reports:

1. Classification of Soils.
2. Compaction Characteristics of Soils.
3. Density and Unit Weight of Soils in Place.
4. Imported fill shall be tested and approved by the Owner's Geotechnical Engineer prior to import to the site, including testing for compliance with Department of Toxic Substances Control (DTSC) guidelines. Said testing and certification documents shall be paid for by the Owner.

C. Project Closeout: In accordance with Specification Section PROJECT CLOSEOUT.

1. Drawings indicating the extent and depth of all engineered fill, and overexcavation and recompaction. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with the Specification Section PROJECT DOCUMENTS.

1.6 QUALITY ASSURANCE

A. Installer:

1. Qualifications:

- a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
  - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
  - b. CF City of Fresno, Codes and Ordinances
  - c. EPA Environmental Protection Agency.

- d. CAL/OSHA Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
- e. DTSC Comply with all recommendations of the California Department of Toxic Substance Control (DTSC) regarding soil testing for potential contaminants.

C. Certificates:

- 1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.
- 2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

- 1. Pre-Installation: Schedule prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
- 2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
- 3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems which may impede issuance of warranties or guaranties.
  - b. Maintain installed work until the Notice of Substantial Completion has been filed.

1.7 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Provide required notification to the Owner and Geotechnical Engineer or the Engineer of Record so that a representative from the Owner's Geotechnical Engineering consultant can be present for all excavation, filling and grading operations to test and observe earthwork construction.
- C. Verify that the location of existing utilities has been indicated at work site by utility authorities, by Owner, and as specified on the Plans.

1.8 EXISTING CONDITIONS

A. Existing Conditions:

1. Examine the site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
2. Thoroughly investigate and verify conditions under which the Work is to be performed.
3. Locate and identify utilities:
  - a. Call a Local Utility Locator Service (USA - “Underground Service Alert” – [800] 227-2600) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.
4. No allowance for Extra Work will be granted resulting from negligence or failure to meet requirements of this Section.

B. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete flatwork, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunk line utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

C. Under similar circumstance, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

D. Determine exact location of existing buried utilities by:

1. Marking on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.
2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations and notify Owner of said request concurrently.
3. Confirm exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

E. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner’s personnel.



- F. Provide Field Engineering to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under this Contract, submit detailed information to the Engineer for review and direction.
- G. Maintain all existing utility mains and service lines in constant service during construction of the Work.
- H. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work, and coordinate the timing of any such disruptions in advance with the District.
- I. Existing soils are considered to have a moderately corrosive potential to buried metal objects.
- J. Existing soils are considered to have a low expansion potential.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
  - 1. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.
  - 2. All land clearing, demolition, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by pre-soaking.
  - 3. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.
  - 4. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.
  - 5. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.
    - a. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
    - b. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. If required, Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
    - c. If a dust control plan is required, no construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan.
    - d. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.

- e. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefore
  - B. Burning: No burning will be allowed on-site.
  - C. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.
  - D. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.
  - E. When reference is made to SWPPP (Storm Water Pollution Prevention Plan), if any within this Project Manual, then comply with all environmental protection requirements included therein.
  - F. In accordance with EPA, CARB and CF.
  - G. Protection:
    - 1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps. Provide dewatering as necessary.
    - 2. Protect cut slopes from erosion due to precipitation and other sources of runoff.
    - 3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Architect promptly for its review and action.
    - 4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.
  - H. Before being brought onto the site, all import soil must be sampled, tested and approved by Owner's Geotechnical Engineer. All import material must comply with DTSC recommendations and guidelines for environmentally clean soil suitable for school construction. Import testing will be provided and paid for by the Owner.
- 1.10 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of GENERAL CONDITIONS and DIVISION 01, GENERAL REQUIREMENTS.
  - B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Fill in Turf or Other Planting Areas: Type S2 or S3 per Division 31 Specification Section 31 22 22 SOIL MATERIALS.
- B. Fill in Non-planting Areas: Type S1, S2 or S4 per Division 31 Specification Section 31 22 22 SOIL MATERIALS.
- C. Imported material: Type S3, S4 or S5 per Division 31 Specification Section 31 22 22 SOIL MATERIALS.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions.

### 3.2 PREPARATION

- A. Layout of Work:
  - 1. Contractor shall be responsible for all lines and grades. Layout shall be provided by a California registered Land Surveyor or Civil Engineer, at Contractor's expense.
  - 2. Check all benchmarks, monuments and property lines and verify locations.
  - 3. Locate and maintain all grade stakes.
  - 4. Monuments moved or displaced during grading operation are to be replaced by a California Registered Civil Engineer or Surveyor, at Contractor's expense.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures, fences, curbs, sidewalks, paving and other improvements to remain from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow and provide for drainage of all excavated areas.
- G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

3.3 SITE STRIPPING:

- A. Reference is made to Division 31 Specification Section 31 11 00 SITE CLEARING.
- B. Within the areas of planned surface improvements and structures, the near surface soils containing vegetation, roots, organics, or other objectionable material must be stripped and removed from the site. Upon approval of the Geotechnical Engineer, suitable materials stripped from the site may stockpiled and incorporated into the finish fill for planting areas.
- C. All areas to receive surface improvements shall be stripped to remove turf, shrubs, trees and other vegetation, along with associated root systems, concrete, wood, metal, rubbish and other unsuitable debris, and any loose, saturated or unconsolidated soil material. Minimum stripping depth is expected to be 3-inches below existing site grades. Stripping shall continue to the depth required to expose acceptable basement soils that are free from deleterious which are not suitable for Engineered Fill, as required by the Geotechnical Engineer.

3.4 EXCAVATION

- A. Following clearing and stripping operations, excavate planned construction areas as specified in this Section.
- B. The proposed project site should be over-excavated a minimum depth of 3 feet below existing ground surface to mitigate hydro-compactive soils.
- C. Following over-excavation activities, all soft or pliant areas of soil identified on site should be removed.
- D. Within the area of the planned building improvements plus at least 5 feet horizontally beyond the perimeter of these improvements, the subgrade must be over-excavated at least 3 feet below the existing ground surface or to the bottom of footings, whichever is lower.
- E. Areas of exterior concrete slabs on grade located outside the building pad over-excavation limits, should be prepared by scarification of the upper 12-inches below existing grade or 12-inches below the bottom of the recommended aggregate base section, whichever is greater. The zone of subgrade preparation should extend a minimum of 3 feet beyond these improvements.
- F. Areas of asphalt concrete improvements should be prepared by scarification of the upper 12-inches below existing grade or 12-inches below the recommended aggregate base section, whichever is greater.
- G. Provide additional excavation as required to conform to the lines, grades and cross-sections shown on the plans.
- H. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw. Remove all roots 1/4" in diameter and greater.
- I. Remove excess soil not to be used as fill in the Work from the site. Unless requested by Owner to be deposited at a site designated by Owner on the property, obtain a disposal site and legally dispose of said excess material, all at no additional cost to the Owner.

- J. Areas disturbed by demolition must be excavated to expose undisturbed soils.
- K. Excavated soils free of deleterious substances (organic matter, demolition debris, tree roots, etc.) and with less than 3% organic content by weight, may be returned to the excavations as Engineered Fill.

### 3.5 FILLING AND COMPACTING

- A. Once clearing, stripping and over-excavation operations are complete, scarify the surface to receive fill material or improvements to a depth of 8-inches, moisture condition to at least 3% above optimum moisture content, and compact to a minimum of 90% of maximum dry density (relative compaction) based on ASTM Test Method 1557.
- B. Place and compact soil to finish subgrade of improvements to be placed thereon, or to finished surface grade where no improvements are to be placed thereon.
- C. All fill required shall be placed as Engineered Fill.
- D. The Contractor shall be solely responsible for securing an acceptable source of import material as required to grade the site. Reference is made to 31 20 00 1.9.H
- E. On-site soils are suitable for re-use as Engineered Fill, providing they are cleansed of excessive organics (less than 3 percent by weight, ASTM D2974), debris, and fragments larger than three (3) inches in maximum dimension and meet the requirements of soil Type S4, Division 31 Specification Section SOIL MATERIALS.
- F. Engineered Fill shall be moisture conditioned to within 3% of optimum moisture, placed in uncompacted layers not exceeding eight (8) inches in thickness, and compacted as specified, based on ASTM Test Method D1557.
  - 1. Non-vegetative surface improvement areas (structures and site concrete improvements) - To a minimum of 90% of maximum dry density .
  - 2. Vegetative surface improvement areas (turf and planters) - Below top twelve (12) inches - to a minimum of 90% of maximum dry density. Top twelve (12) inches - 85% of maximum dry density.
  - 3. Pavement areas: to a minimum 95% of maximum dry density in top twelve (12) inches.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Additional lifts shall not be placed if the previous lift did not meet the required dry density, or if soil conditions are not stable.
- I. Conform fill to the lines, grades and cross-sections shown on the plans.
- J. Fill materials to conform to Division 31 Specification Section 31 22 22 SOIL MATERIALS.
- K. Provide, at no additional cost to Owner, imported soil material conforming to the requirements of Division 31 Specification Section SOIL MATERIALS, as needed to attain finished grades of Work.
- L. Utilize equipment which will not disturb or damage existing utilities and other improvements.

### 3.6 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

- A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with this section.
- B. Scarify the soil as specified and remove and dispose of (off the project site) all rocks, hardpan chunks or otherwise unsuitable material over 3-inches in size.
- C. Thoroughly moisture condition and compact as described above.
- D. Prior to commencing construction of surface improvements, pass a test roller of size and weight as approved by the Owner over the subgrade to establish the extent of soft or spongy areas requiring repairs.
- E. Conform finished subgrade surface to the lines, grades and cross-sections shown on the plans.

### 3.7 FINE GRADING

- A. Fine grade all finished surfaces to the lines, grades and cross-sections shown on the plans, and to blend to hard surface improvements.
- B. Rake and smooth all finished surfaces not to receive hard surface improvements.
- C. Use suitable stockpiled or imported topsoil for the top 12-inches of areas to receive landscape improvements.
- D. Import topsoil meeting the requirements of Division 31 Specification Section SOIL MATERIALS, as required to complete finish grading.
- E. Topsoil may not be used in areas requiring Engineered Fill.

### 3.8 TOLERANCES

- A. Top surface of Subgrade for Non-Vegetative Surface Improvements or Layers thereof: Plus or minus 0.02 foot from planned elevation.
- B. Top surface of Subgrade for Vegetative Surface Improvements or for Bare Ground - Plus or minus 0.05 foot of planned elevation, or as required for finish surface to match adjacent improvements or ground.

### 3.9 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of GENERAL CONDITIONS and/or DIVISION 01, GENERAL REQUIREMENTS.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.
- D. All retesting required as a result of failure of initial test will be performed by Owner's testing agency, at the expense of the Contractor.

3.10 PROTECTION

- A. Protect graded areas from traffic, freezing, erosion, and all other sources of damage. Keep free of debris and trash.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed work becomes eroded, rutted, settled, or where it is damaged by subsequent construction operations or weather.
- C. Where settlement occurs prior to acceptance of the work, remove and replace surface improvements, excavate, replace, and re-compact in accordance with these specifications, and restore the surface improvements.

3.11 CLEANING

- A. Remove all surplus or unsatisfactory soil material, trash, and debris, and legally dispose of off of the Owner's property.

END OF SECTION

## SECTION 31 22 22 - SOIL MATERIALS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY:

## A. SECTION INCLUDES

- 1. Excavated (and re-used) materials and imported materials.

## 1.3 RELATED SECTIONS:

- 1. Section 31 20 00 - Earthwork: Excavation, Filling and Grading.
- 2. Section 31 23 33 - Trench Excavation and Backfill.

## 1.4 SUBMITTALS

- A. Samples: Submit, in air-tight containers, 10 lb. sample of Type S3, S4 and S5 fill to inspector.
- B. Soil Analysis: Submit for Type S3, S4 and S5 soils to be imported.
- C. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.
- D. For imported soil, obtain Geotechnical Engineer and District approval prior to importing.

## PART 2 - PRODUCTS

## 2.1 SOIL MATERIALS

- A. Soil Type S1: Excavated and re-used material, graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Soil Type S2: Excavated and reused material, graded; free of roots, lumps greater than one inch, rocks larger than 1/2 inch, debris, weeds and foreign matter.
- C. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than 1/2 inch, debris, weeds, and foreign matter.



- D. Soil Type S4: Imported borrow, suitable for purposes intended, meeting the following characteristics:
1. Percent Passing 3-inch sieve: 100
  2. Percent Passing 3/4 -inch Sieve: 80-100
  3. Percent Passing #4 Sieve: 60-100
  4. Percent Passing #200 Sieve: 20-50
  5. Expansion Index: <20
  6. Plasticity Index: <9
  7. R-Value (in paved areas): >13
  8. Low Corrosion Potential
    - a. Soluble Sulfates: <2,000 mg/Kg
    - b. Soluble Chlorides: <500 mg/Kg
    - c. Soil Resistivity: >2,000 ohm-cm
- E. Soil Type S5: Imported sand. Natural river or bank sand (sand equivalent greater than 30), washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

## 2.2 SOURCE QUALITY CONTROL

- A. Inspection of imported soil will be performed by the Geotechnical Engineer, at source of import and prior to being delivered to the site.

## PART 3 - EXECUTION

### 3.1 STOCKPILING

- A. Stockpile excavated or imported material onsite at location designated by project inspector.
- B. Stockpile excavated or imported material in sufficient quantities to meet project schedule and requirements.

### 3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.
- B. Dispose of excess material off-site.

END OF SECTION

## SECTION 31 23 33 - TRENCH EXCAVATION AND BACKFILL

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. A Geotechnical Engineering Investigation Report has been prepared for the project by TECHNICON Engineering Services, Inc. TECHNICON Project No. 240005.001, dated March, 15, 2024. A copy of the report is available (for reference only) at the cost of reproduction. Contact TECHNICON Engineering Services, Inc. if a copy of the report is desired.

## 1.2 SUMMARY:

- A. SECTION INCLUDES
  - 1. Excavating trenches, holes and pits for constructing the Work.
  - 2. Backfill and compaction.
  - 3. Providing suitable bedding and backfill material, as specified herein.
- B. RELATED SECTIONS
  - 1. Contract General Conditions and Division 01, General Requirements.
  - 2. Section 31 11 00 - Site Clearing
  - 3. Section 31 20 00 - Earthwork: Excavation, Filling and Grading
  - 4. Section 31 22 22 - Soil Materials
  - 5. Section 33 12 00 - Water Utilities
  - 6. Section 33 30 00 - Site Sewer Systems
  - 7. Section 33 40 00 - Storm Drainage

## 1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

## 1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate devices or appurtenances, or substructure pertaining hereto.

## 1.5 QUALITY ASSURANCE

### A. Qualifications

#### 1. Installer:

- a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project within the past 5 years.

### B. Regulatory Requirements:

1. In accordance with Specification Section REGULATORY REQUIREMENTS and the following:
  - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB].
  - b. CF City of Fresno, Codes and Ordinances
  - c. EPA Environmental Protection Agency.
  - d. CAL/OSHA Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.

### C. Certificates:

1. Installer's certification that all trench backfill installation meets or exceeds the requirements of this specification.
2. Contractor's certification (on Contractor's letterhead paper) that the trench backfill materials and installation meets or exceeds the requirements of this specification.

### D. Meetings:

1. Pre-Installation: Schedule prior to the start of work.
  - a. Coordinate the work with other work being performed.
  - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor during the performance of the work.
  - a. Review for proper installation of work progress.
  - b. Identify any installation problems and acceptable corrective measures.
  - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor upon proper completion of the work.
  - a. Inspect and identify any problems which may impede issuance of warranties or guaranties.

4. Maintain installed work until the Notice of Substantial Completion has been filed.

#### 1.6 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

#### 1.7 EXISTING UTILITIES

- A. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the Engineer will have made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Under circumstance similar to 31 23 33/1.7A, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. Determine exact location of existing buried utilities by:
  1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
  2. Requesting Underground Service Alert (USA) to indicate location of existing buried facilities (phone 1-800-227-2600). Provide USA a minimum of two (2) working days notice of request for locations, and notify Owner of said request concurrently.
  3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.
- D. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.
- E. Provide Field Engineering per Contract General Conditions and Division 01 to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under the Contract, submit detailed information to the Owner's Inspector and Engineer for review and direction.

- F. Maintain all existing utility mains and service lines in constant service during construction of the Work.
- G. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

## PART 2 - PRODUCTS

### 2.1 FILL MATERIALS

- A. Fill Type S1, S2, S4 and S5, as specified in Division 31 Specification Section SOIL MATERIALS.

### 2.2 WARNING TAPE

- A. 6" wide warning tape shall be installed over all of the pipelines as shown on the details.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- B. Protect existing structures, fences, sidewalks, curbs, and other improvements from excavation equipment and vehicular traffic.
- C. Maintain and protect above and below grade utilities which are to remain.
- D. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.

### 3.2 EXCAVATION

- A. Excavate soil required to locate existing utilities and install the work.
- B. Use hand methods of excavation to locate existing utilities, and to excavate trenches, pits and holes in congested areas.
- C. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined by hand methods of excavating.

- D. Cut trenches just wide enough to enable installation and proper bedding and backfill, and to allow inspection.
- E. Do not interfere with (2:1) bearing splay of foundations.
- F. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose material.
- G. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings. No additional payment will be made for such over-excavation and refill.
- H. In all trenches or excavation sites where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches, or to a depth determined by the Engineer, below the bottom of the proposed pipe or structure, and backfill the space with Type S2 or S5 material containing sufficient moisture to allow compaction to 90% maximum dry density. Soil Type S2 shall meet requirements of Type S5. No additional payment will be made for such additional excavation or backfill.
- I. Excavate trenches to provide the design grade of the facility, or as directed by the Engineer.
- J. Stockpile excavated material to be returned to trench adjacent thereto in location which will not be detrimental to existing improvements, or pedestrian or vehicular traffic. Remove from site all unsuitable or excess material not to be used.
- K. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.
- L. Remove excess soil not used as backfill from the work site. Obtain a disposal site off of the Owner's property and legally dispose of said excess material, all at no additional cost to the Owner.
- M. If water is encountered during excavations, provide all dewatering measures necessary to construct improvements shown.
- N. Contractor shall make all provisions necessary, including but not limited to, shoring or sloping back trench walls as required to address sandy soils. The cost of these provisions shall be included in the lump sum amount bid for this work and no separate payment will be made therefore.

### 3.3 PROTECTION OF EXCAVATIONS

- A. Provide all shoring and bracing as required and those codified in local, state and federal safety regulations.
- B. Prevent water, caving or sloughing ground from entering excavations.
- C. Maintain excavations free of water.

### 3.4 BACKFILLING

- A. Provide type S5 pipe bedding as required by Plans and compact to 90% maximum dry density.
- B. After installation of pipes and appurtenances and placement of pipe bedding material, backfill trenches and excavations to finished grade, or subgrade in areas to receive surface improvements
- C. Backfill trenches to a minimum of 6 inches above the pipe and any couplings with Type S5 material, containing sufficient moisture to allow compaction to 90% maximum dry density.
- D. Backfill trenches above pipe bedding material and to within 24 inches of finish subgrade with Type S1, S2, S4, or S5 soils, except that that top 12 inches shall be type S2, S3, S4 or S5 soils.
- E. Employ a placement method that does not disturb or damage existing or proposed pipes or other Utilities or Improvements.
- F. Place and compact all soil backfill in continuous layers not exceeding 8 inches in loose uncompacted thickness, moisture condition to at least 3% above optimum moisture content.
- G. Maintain optimum moisture content of fill materials to attain required compaction.
- H. Backfill final 12-inch thickness to finish subgrade in areas to receive concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvement, with Type S2, S4, or S5 soils.
- I. Backfill final 12-inch thickness to finish subgrade in areas to receive sod, other vegetation, or bare soil, with Type S2 or S3 soils.
- J. Compact backfill below the top 12-inches to 90% maximum dry density.
- K. In areas to receive buildings, structures, or concrete flatwork, compact the top 12-inches to 90% maximum dry density.
- L. In areas to receive asphalt concrete pavement or concrete pavement subject to vehicular traffic, compact the top 12-inches to 95% maximum dry density.
- M. In planting areas, compact the top 12-inches to 85% maximum dry density.

### 3.5 TOLERANCES

- A. Top Surface of Backfill under Paved or Concrete Areas: Plus or minus 0.02 feet from required elevations.
- B. Top Surface of General Backfilling: As required for finish surface to match adjacent improvements or ground.

### 3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of General Conditions and/or Division 01.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, and retest. Retests required due to failure of initial tests shall be paid for by the Contractor.

### 3.7 PROGRESS AND PROSECUTION

- A. Backfill any excavation opened in any day on that same day.

END OF SECTION



## SECTION 31 31 00– SOIL TREATMENT

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide all material, labor, equipment and services necessary to provide Termite Control and Herbicide, and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Sections:
  - 1. DIVISION 00 SPECIFICATION SECTIONS.
  - 2. DIVISION 01 SPECIFICATION SECTIONS.
  - 3. 03 30 00 CAST-IN-PLACE CONCRETE
  - 4. 31 20 00 EARTHWORK
  - 5. 33 40 00 STORM DRAINAGE
  - 6. SPECIFICATION SECTIONS IN THE FACILITY SERVICES SUBGROUP.
  - 7. SPECIFICATION SECTIONS IN THE SITE AND INFRASTRUCTURE SUBGROUP.

## 1.2 SUBMITTALS

- A. Submit in accordance with Specification Section - SUBMITTAL PROCEDURES:
- B. Product Data for each type of product specified:
  - 1. Include the EPA Registered Label showing the Active Ingredients and their percentages.
- C. Quality Assurance/Control Submittals:
  - 1. Certificates:
    - a. Indicating compliance with applicable regulations for all products, signed by product manufacturer.
    - b. Installers Qualification for products specified.
  - 2. Manufacturer's written Instructions for each type of product specified:
  - 3. Test reports:
    - a. Soil Treatment application.

## 1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents in accordance with Specification Section - PROJECT DOCUMENTS.
  - 1. Identify and accurately locate extent of treatment on the Site Plans.
- B. Warranty in accordance with Specification Section - WARRANTIES.
  - 1. Special Warranty specified within this specification section.

## 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Material Qualifications:
    - a. All products shall comply with all applicable EPA regulations and standards in the place where the Project is located, and in effect at the time of application.
    - b. Obtain termite control products from a single manufacturer for each product.
  - 2. Installer Qualifications:
    - a. A specialist who is EPA approved and licensed according to regulations of authorities having jurisdiction to apply termiticides and herbicides in the jurisdiction where the project is located.
- B. Regulatory Requirements:

1. In accordance with Specification Section - REGULATORY REQUIREMENTS and the following:
    - a. EPA Environmental Protection Agency – All Applicable Environmental Protection Regulations and Standards.
    - b. USDA United States Department of Agriculture.
    - c. All products will comply with the current EPA laws and California Rules and Regulations at the time of application. Should the products listed become unavailable because of changes in the law, submit substitute products in accordance with Section - SUBSTITUTION PROCEDURES for review by the Architect.
  - C. Meetings:
    1. Pre-Installation: Scheduled by the Contractor prior to the start of work.
      - a. Coordinate the work with other work being performed.
      - b. Identify any potential problems that may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
    2. Progress: Scheduled by the Contractor during the performance of the work.
      - a. Review for proper installation of work progress.
      - b. Identify any installation problems and acceptable corrective measures.
      - c. Identify any measures to maintain or regain project schedule if necessary.
    3. Completion: Scheduled by the Contractor upon proper completion of the work.
      - a. Inspect and identify any problems that may impede issuance of warranties or guaranties.
      - b. Maintain installed work until the Notice of Substantial Completion has been executed.
- 1.5 PROJECT CONDITIONS
- A. Environmental requirements:
    1. To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
  - B. Existing Conditions:
    1. Examine site and compare it with the drawings and specifications. Thoroughly investigate and verify conditions under which the work is to be performed. No allowance will be made for extra work resulting from negligence or failure to be acquainted with all available information concerning conditions necessary to estimate the difficulty or cost of the work.
    2. Conduct work so as not to interfere unnecessarily with adjacent roads, streets, drives and walks.
- 1.6 SEQUENCING AND SCHEDULING
- A. Coordination:
    1. Coordinate soil treatment application with excavating, filling, grading, and concrete operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- 1.7 WARRANTY
- A. Contractor's General Warranty:
    1. In accordance with Specification Section - WARRANTIES.
  - B. Manufacturer's Warranty: 5 Years from the date of Substantial Completion.

1. Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
- C. Installer's Warranty: 1 Year.
  1. In accordance with the terms of the Specification Section – WARRANTIES.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. These products listed herein establish the size, pattern, color range and function selected by the Architect for this Project. Manufacturers that are listed as acceptable alternative manufacturers and substitutions must still comply with the requirements of this project and the products listed in order to be approved as an equivalent during the Submittal Process. If the acceptable alternative manufacturers listed or substitutions are not approved during the Submittal Process due to non-compliance with the contract documents, then the Contractor shall submit product specified.
- B. Products from other manufacturers not listed must submit in accordance with Specification Section - SUBSTITUTION PROCEDURES.

### 2.2 TERMITICIDE

- A. PREMISE® 75 insecticide in water soluble packets as manufactured by BAYER CORPORATION, delivered in a minimum of a 0.1 percent solution as indicated by the label and in accordance with local environmental regulations, or approved equivalent.
  1. Active Ingredients:
    - a. Imidacloprid, 1-((6-Chloro-3-pyridinyl)methyl)-N-nitro-2-imidazolidinimine: 75.0 percent.
    - b. Inert Ingredients: 25.0 percent.
    - c. Total: 100.0 percent.
- B. WISDOM TC Flowable 0.06 percent emulsion for subterranean Termites.
  1. Active Ingredients:
    - a. Bifenthrin: 7.9 percent.
    - b. Other ingredients: 92.1 percent.

### 2.3 HERBICIDE

- A. Commercial chemical for weed control registered by the EPA and the State of California. Provide granular, liquid, or wettable powder form.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Termiticide:
  1. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
    - a. Proceed with application only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

## 3.3 APPLICATION

- A. General:
  - 1. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.
- B. Applying Termiticide for Pre-Construction Treatment:
  - 1. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide per the soil conditions present, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticide barrier or treated zone is established around and under building construction. Distribute treatment evenly.
    - a. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
      - 1) If the slab-on-grade construction is applied directly over the vapor retarder/barrier, then apply the termiticide just under the vapor retarder/barrier just prior to its placement. Spray all penetrations on top of the vapor retarder/barrier after it is placed and sealed, and just prior to the placement of the concrete.
      - 2) If the slab-on-grade construction is applied over a sand layer laid on top of the vapor retarder/barrier, then apply the termiticide directly over the sand layer just prior to the placement of the concrete.
    - b. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
    - c. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
    - d. Masonry: Treat voids.
    - e. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
  - 2. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
  - 3. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
  - 4. Post warning signs in areas of application.
  - 5. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

- C. Applying Termiticide for Post-Construction Treatment:
  - 1. New construction shall always require Pre-Construction Treatment.
  - 2. Only if the project involves Modernization and Termiticide
  - 3. Treatment is required, follow product label instructions for Post-Construction Treatment.
- D. Applying Herbicide Treatment:
  - 1. Extent of Herbicide Application: Soil under all asphaltic concrete paving, including driveways, parking areas, and athletic courts.
  - 2. Application:
    - a. Prepare substrate in accordance with manufacturer's written recommendations.
    - b. Apply Herbicide Solution over sub-base prior to application of asphaltic concrete.
    - c. Apply in form allowed by the EPA label.
    - d. Rate of Application: As recommended by the label.
    - e. Take all precautions to limit herbicide treatment to areas immediately under paved areas.

### 3.4 FIELD QUALITY CONTROL

- A. Soil Treatment Application Report: After application of soil treatment is completed, submit report for Owner's record information, including the following:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Brand name and manufacturer of termiticide.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes, and rates of application used.
  - 6. Areas of application.
  - 7. Water source for application.

END OF SECTION

## SECTION 32 01 90- EXISTING LANDSCAPE PROTECTION

## PART 1 - GENERAL

## 1.1 SCOPE OF WORK

- A. This Section includes but is not limited to the following:
  - 1. Protection and maintenance of existing trees and other plants that are affected by the execution of the Work, whether temporary or new construction.
- B. Related Work Specified Elsewhere
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections.
  - 2. Section 31 11 00: Site Clearing
  - 3. Section 31 20 00: Earthwork
  - 4. Section 31 23 33: Trench Excavation and Backfill
  - 5. Section 32 84 00: Irrigation System
  - 6. Section 32 90 00: Landscape Planting

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated or proposed for use.
- B. Qualification Data: Submit arborist's certification and/or license information. Submit qualifications and experience of the certified tree worker if not the arborist.
- C. Project Certification: Provide a certification letter from the consulting arborist that trees indicated to remain have been protected during construction according to these specifications and/or the arborist's recommendations and provide a list of any trees damaged during construction and the subsequent treatment and repair.
- D. Transplanting and Maintenance Recommendations: Submit transplanting, maintenance and protection specifications from a qualified arborist for care and protection of trees during and after completion of the Work that are likely to be affected by construction operations. The tree maintenance recommendations shall be included in the Maintenance Manuals required in 329000.
- E. Tree Assessment and Valuation: Prior to the start of any construction operations of any kind, submit a tree assessment including tree valuation for existing trees scheduled to remain in the area of work or in auxiliary construction areas.
  - 1. Tree valuation for trees species that do not have comparable and available replacement sizes shall be determined by a certified consulting arborist experienced in tree valuation using the "Guide for Establishing Values of Trees and Other Plants", current edition, published by the International Society of Arboriculture, Urbana, Illinois.
  - 2. Tree assessment shall include a physical description, health, condition and recommended pruning and/or mitigation measures based on the expected construction operations to minimize the negative impacts to the affected trees.

## 1.3 QUALITY ASSURANCE

- A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and/or relocation work similar to that required for this Project, and who will provide experienced, certified tree workers.
- B. Arborist Qualifications: The arborist shall be certified by the International Society of Arboriculture. If the arborist is performing tree work, he/she shall be employed by a licensed contractor, or shall hold an individual license if independent.
- C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated or recommended by the certified arborist.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.
- B. Topsoil: See Section 32 90 00.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers, minimum 4.8 oz/sq. yd.
- D. Temporary chain link fencing at the TPZ shall be installed with a minimum 5' high fabric on 2 inch diameter metal posts with a minimum 2 foot embedment into the soil spaced at a maximum 10 feet.
- E. Wood mulch: Walk-on type chipped wood and aged greenwaste material without leaves, green wood, sticks, dirt, dust, construction materials and other debris. Particle size 1/2" to 3" in general size.
- F. Coarse sand: Clean sand with greater than 95% passing a #10 sieve, less than 5% passing a #30 sieve, and less than 1% passing a #50 sieve.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Temporary Fencing: Install temporary fencing located around the canopy drip line of trees (the tree protection zone [TPZ]), and around the plants scheduled to remain that are inside the construction area. The TPZ fence layout shall be reviewed for acceptance by the Owners Representative and the consulting arborist.
- B. All work within the TPZ shall be reviewed and monitored by the consulting arborist.
- C. Within the TPZ, install a 4 inch depth of wood mulch over a permeable filter fabric with minimum 4 inch overlaps at fabric seams. Remove the protection mulch and fabric prior to any cultivation and amendment tillage.

- D. Provide a temporary dirt berm watering basin around trees and plants scheduled to remain. The berm around trees shall be a minimum diameter of six times (6x) the diameter of the tree at breast height (DBH), or not less than six feet in diameter, whichever is greater.
- E. Provide temporary irrigation or a portable water source to irrigate trees and plants scheduled to remain. Irrigate at minimum once a week or more often as necessary to moisten soil to a minimum 18 inch depth for trees, and a minimum depth of 12 inches for shrubs. Reapply irrigation based on an evapotranspiration loss of 50%.
- F. Protect plant/tree root systems within the protected fenced areas from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
- G. Do not store construction materials, debris, or excavated material within the TPZ. Do not permit vehicles or reoccurring foot traffic within the TPZ to prevent soil compaction over root systems.
- H. Do not allow fires under or adjacent to remaining trees or other plants.

### 3.2 EXCAVATION

- A. Do not excavate within the canopy drip line of existing trees unless otherwise authorized. Any excavation within the TPZ shall be performed under the onsite monitoring by the consulting arborist.
- B. Where excavation for new construction and/or utility lines are required within the canopy drip line of trees, hand clear and excavate to minimize damage to root systems. Use spading forks to comb soil or use an Air-Spade to expose roots.
- C. Where utility lines are to be located within the drip line of trees, expose the existing root system to the depth of utility line installation plus the depth of any required bedding material. Place piping below and/or through the exposed roots without damage to the root system. Backfill with approved material and compact by flooding the area if allowed.
- D. As an alternative to manual or Air-Spade trench excavation, utility or other below grade piping may be mechanically bored under the crown dripline with a minimum cover of 3 feet as authorized by the consulting arborist.
- E. Root Pruning: Do not cut main lateral roots or taproots greater than one inch in diameter. Smaller roots less than one inch in diameter that interferes with the installation of new improvements and/or utility lines may be cut only if absolutely necessary. Only cut roots with sharp pruning instruments; do not break, tear or chop. Block out concrete footings around roots greater than one inch diameter leaving a minimum one inch clearance around roots to remain. Provide alternative footing design if main lateral roots are in conflict.

### 3.3 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by the certified arborist, unless otherwise indicated.



1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots less than one inch diameter. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 12 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations. Do not place fill greater than 6 inches in depth within 24 inches of the trunk, and do not cover the trunk/root base flare. Do not allow standing water at the trunk.
- C. Moderate Fill: Where existing grade is more than 12 inches , but less than 18 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
  1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of existing grade and extend not less than 20 inches from tree trunk on all sides up to the finish grade. Slope of the rock fill shall be a maximum 2h:1v. For balance of area within drip-line perimeter, place drainage fill a minimum 6 inches in depth.
  2. Place filter fabric over the drainage fill with edges overlapping 6 inches minimum.
  3. Place fill layer of topsoil to finish grade. Do not mechanically compact drainage fill or topsoil more than 85% relative density in planted areas. Hand grade to required finish elevations.

#### 3.4 TREE PRUNING

- A. Prune remaining trees affected by temporary and new construction only when authorized by the Landscape Architect and as recommended by the consulting arborist.
- B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system only when authorized by the Landscape Architect and as recommended by the consulting arborist. Provide subsequent maintenance during Contract period as recommended by the consulting arborist.
- C. Pruning Standards: Prune trees according to ANSI A300 based on pruning for access clearance, to correct any defects in structure, or to remove potential conflicts with new improvements. Pruning shall only be performed by a Certified arborist or tree worker.
- D. Cut branches with sharp pruning instruments; do not break or chop. Clean pruning tools with a diluted bleach solution prior to performing any pruning operations.

#### 3.5 TREE REPAIR AND REPLACEMENT

- A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the arborist.
- B. Remove and replace dead and/or damaged trees impacted by the construction operations that the arborist determines to be incapable of restoring to a normal growth pattern.
  1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in 32 90 00.
  2. When new trees of the same size and species are not available, furnish and install the largest size boxed tree that is readily available and will successfully grow in the planting area with long term health and without damage to adjacent improvements.

Credit the Owner the difference between the valuation of the removed existing tree and the installed replacement tree.

- C. Aerate surface soil within any existing Oak tree dripline compacted before or during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 18 inches deep at 36 inches o.c. Backfill holes with coarse sand. Manually till the top 4 inches with a spading fork, and break up clods greater than 1 inch diameter. Smooth grade prior to installing wood mulch.

### 3.6 CLEAN-UP

- A. Burning is not permitted.
- B. Prior to Final Acceptance, remove the TPZ fence, stakes and other related materials.
- C. Legally remove excess excavated material, debris, displaced trees, and greenwaste from Owner's property. Broom clean all hardscape surfaces in the area of work.

END OF SECTION

## SECTION 32 11 26 - AGGREGATE BASE COURSE

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to install aggregate base surfacing as indicated by the Contract Documents.

## 1.3 RELATED SECTIONS

- A. All Division 00 Specification Sections
- B. All Division 01 Specification Sections
- C. Section 31 20 00 – Earthwork: Excavation, Filling, and Grading.
- D. Section 31 23 33 – Trench Excavation and Backfill.
- E. Section 32 12 16 – Soil Sterilization
- F. Section 32 12 17 – Asphalt Paving
- G. Section 32 13 13 – Site Concrete Improvements.

## 1.4 REFERENCES

- A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials

## 1.5 QUALITY ASSURANCE

- A. Provide and install in accordance with SSCDOT.

## 1.6 SUBMITTALS

- A. Submit data sheets from supplier to document compliance with SSCDOT requirements.
- B. Certificates of compliance for material.
- C. Load tags for delivered material.

### 1.7 COORDINATION

- A. Coordinate with other work, including subgrade preparation and soil sterilization.
- B. Coordinate installation schedule with Owner's use of the premises and with other contractors working at the site.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Aggregate Base: Unless specified otherwise on Plans, Class 2, 3/4 Inch Maximum per Section 26 of SSCDOT.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify quantities required.
- B. Verify that subgrade has been placed and compacted per Contract Documents
- C. Verify gradients and elevations of subgrade are correct.

### 3.2 INSTALLATION OF AGGREGATE BASE COURSE

- A. Install in conformance with SSCDOT Section 26, Aggregate Bases.
- B. Thickness - As shown on construction drawings.
- C. Spreading and Compacting - In accordance with Section 26, SSCDOT. Base course shall be moisture conditioned to within 2% of optimum moisture, placed in uncompacted layers not exceeding six (6) inches in thickness, and compacted as specified, based on ASTM Test Method D1557. The maximum dry density compaction of each layer of compacted base material shall be not less than 95 percent.
- D. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities, true to grade and cross-section.
- E. Lines and grades for the installation of aggregate base shall be set by a California licensed Land Surveyor or Civil Engineer, at Contractor's expense.

### 3.3 TOLERANCES

- A. Compacted thickness of aggregate base: Not less than the thickness specified on the Plans.
- B. Finished Surface: Within 0.02 foot of planned grade per Section 26, SSCDOT. No more than 50% of the finish surface shall be above or below the specified grade for aggregate base.

### 3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed by the Owner's inspector, under provisions of Division 01.

### 3.5 PROTECTION

- A. Immediately after placement and compaction, protect surface from mechanical injury.
- B. Protect completed surface until surfacing layers are in place.

END OF SECTION

## SECTION 321216 - SOIL STERILIZATION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to the work specified in this section.

## 1.2 SECTION INCLUDES

- A. Furnish and install soil sterilant under all asphalt paving.

## 1.3 RELATED SECTIONS

- A. All Division 01 Specification Sections
- B. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading
- C. Section 31 23 33 - Trench Excavation and Backfill
- D. Section 32 11 26 – Aggregate Base Course
- E. Section 32 12 17 – Asphalt Paving

## 1.4 STANDARDS

- A. In accordance with the following:

CCR-T21	California Code of Regulations, Title 21 Public Works.
CBC	California Building Code, California Code of Regulations, Title 24, Part 2, CCR-T24.
USDA	United States Department of Agriculture.
EPA	Environmental Protection Agency.
CF	City of Fresno
	All applicable Environmental Regulations and Standards.

## 1.5 QUALITY ASSURANCE

- A. Provide licensed operator to apply soil sterilant.
- B. All products shall comply with the current EPA laws at time of application. Should the products listed become unavailable because of changes in the law, submit substitute products for review by the Owner.

## 1.6 SUBMITTALS

- A. Submit in accordance with Specification Section SUBMITTAL PROCEDURES.

- B. Certificates of application.
- C. Certificates of compliance for material.

#### 1.7 COORDINATION

- A. Coordinate with other work, including subgrade preparation.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Soil Sterilant: Bayer Oust XP, weed and grass preventer, or approved equal.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that site is ready for application.

#### 3.2 PREPARATION

- A. Identify installation locations.
- B. Employ equipment and methods appropriate to the work site.

#### 3.3 APPLICATION

- A. Thoroughly water soak surface to be treated. Avoid excessive water runoff.
- B. Apply sterilant solution over surface to receive pavement or surfacing prior to the start of pavement or surfacing installation.
- C. Apply in spray form, at rate as allowable by State of California and the manufacturer's recommended application rate.
- D. Take all precautions to limit soil sterilant solution to areas immediately under proposed pavement or surfacing. Use shields as necessary, and do not apply under windy conditions.

3.4 FIELD QUALITY CONTROL

- A. Field inspection will be performed under Specification Section QUALITY REQUIREMENTS.

END OF SECTION



## SECTION 32 12 17 - ASPHALT PAVING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Provide all material, labor, equipment and services necessary to completely install all pavement materials, accessories and other related items as required by the Contract Documents.

## 1.3 RELATED SECTIONS:

- A. All Division 00 Specification Sections
- B. All Division 01 Specification Sections
- C. Section 31 22 00 - Earthwork: Excavation, Filling, and Grading
- D. Section 31 23 33 - Trench Excavation and Backfill
- E. Section 32 11 26 - Aggregate Base Course.
- F. Section 32 12 16 - Soil Sterilization.

## 1.4 REFERENCES

- A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.

## 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with SSCDOT.
- B. Mixing Plant: Conform to SSCDOT.
- C. Installation Criteria: Asphalt concrete shall show no evidence of cracking, uneven settlement, improper drainage, or untoward junctions with adjoining or existing surfaces. Work displaying such conditions shall be corrected under the Contractor's guarantee of all work.

## 1.6 SUBMITTALS

- A. Submit under provisions of Division 01.

- B. Mix design
- C. Certificates of compliance for material.
- D. Load tags for delivered material.

#### 1.7 COORDINATION

- A. Coordinate with other work, including subgrade preparation, aggregate base placement and soil sterilization.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt-concrete when atmosphere temperature is less than 50 degrees F, or surface is wet or frozen.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Paint Binder: In accordance with SSCDOT Section 94, Asphaltic Emulsions.
- B. Asphalt-Concrete: Type A in accordance with Section 39, SSCDOT, ½ inch maximum aggregate (medium) as indicated on the Plans. The asphaltic concrete shall be compacted to an average relative compaction of 97 percent, with no single test value being below a relative compaction of 95 percent based on a 50 blow Marshall maximum density. Use asphalt binder performance grade PG 64-10.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify quantities required. New asphalt-concrete paving is required at all locations shown on the plans, and where existing asphalt-concrete paving to remain is removed or damaged by the Project excavation or related work.
- B. Verify that subgrade or base material has been compacted to required relative compaction and is dry.
- C. Verify gradients and elevations of base are correct.
- D. Verify that subgrade or base material has been sterilized per Section 32 12 16 SOIL STERILIZATION.

### 3.2 AGGREGATE BASE

- A. Where shown on the construction plans, place and compact aggregate base course per Section 32 11 26 AGGREGATE BASE COURSE.
- B. Where shown on the construction plans, place asphalt on compacted earth subgrade per Section 31 20 00 EARTHWORK: EXCAVATION, FILLING AND GRADING and Section 31 23 00 TRENCH EXCAVATION AND BACKFILL.
- C. A soil sterilant shall be applied over the entire area which is to be paved in accordance with Section 31 12 16 SOIL STERILIZATION

### 3.3 PREPARATION – PAINT BINDER

- A. Apply paint binder to existing asphalt-concrete or concrete surfaces which will be in contact with asphalt-concrete surfacing.
- B. Rate of application for all surfaces against which asphalt concrete is to be placed shall be no less than 0.02 and no more than 0.05 gallons per square yard. All vertical concrete surfaces which will be in contact with asphalt concrete surfacing and all areas now in place which will be covered with new surfacing materials and feathering operations shall be coated with a paint binder applied at the rate of 0.05 gallons per square yard.

### 3.4 INSTALLATION OF ASPHALTIC-CONCRETE

- A. Install in conformance with SSCDOT Section 39, Asphalt-Concrete.
- B. Thickness - As shown on construction plans. Where thickness exceeds 3 inches, place in no less than 2 layers with top layer no thicker than one inch. Asphaltic concrete shall be laid to the thickness designated on the Plans. The plan thickness is to be considered as a minimum thickness. The Contractor shall lay the asphaltic concrete to a depth required to insure that, after compaction, the in place compacted thickness is equal to or greater than the specified plan thickness.
- C. The Contractor shall provide to the Engineer the truck delivery weight tags for the asphaltic concrete material. The quantity delivered shall be equal to or greater than the calculated in place quantity based on the specified thickness and area to be paved as designated on the construction plans and based on a unit density of the asphaltic concrete of 141 pounds per cubic feet.
- D. Compaction Equipment - In accordance with Section 39, SSCDOT. At small difficult areas, equipment may be altered as approved by Engineer.
- E. The completed surface shall be thoroughly compacted, free from ruts, depressions, and irregularities and to be true to grade and cross-section.

### 3.5 TOLERANCES –GENERAL

- A. Finished Surface: within 0.02 foot of planned grade.
- B. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
- C. Scheduled Compacted Thickness: Not less than specified.

### 3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Pavement shall comply with the following:
  - 1. Water shall not be able to accumulate at any point and the surface shall be free to drain to drainage inlets or gutters.
  - 2. The paving contractor shall water flood the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, “bird baths” are evident in a depth more than 0.01 foot, the paving contractor and the Owner’s representative will determine the best method of correction.
  - 3. A 10 foot straightedge shall be used to check for high spots and ridges. High spots and ridges out of compliance shall be reduced by a remedy determined by the paving contractor and the Owner’s representative.
- C. Should a section of the work be not acceptable on the basis of inadequate compaction and/or the mixture becomes loose and broken, mixed with dirt, out of tolerance, or in any other way defective, it shall be repaired or removed and replaced with fresh mixture and immediately compacted to conform to the surrounding area to the satisfaction of the Owner.

### 3.7 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury.
- B. Protect sealed surface until it is cured.

END OF SECTION

## SECTION 32 13 13 - SITE CONCRETE IMPROVEMENTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY:

- A. This Section includes the following:
  - 1. All material, labor, equipment and services necessary to completely install exterior Portland cement flatwork, cast-in-place concrete, and architectural flatwork concrete, accessories and other related items, slabs, ramps and sidewalks and walkways, curb and gutter, mowstrips, and other miscellaneous concrete items of the form and dimensions shown on the plans and necessary to complete the project, and in accordance with the requirements of the Standard Specifications as modified and supplemented by these Special Provisions
  - 2. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to the work of this section.
- B. RELATED SECTIONS:
  - 1. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading
  - 2. Section 32 11 26 – Aggregate Base Course
  - 3. Section 32 13 15 - Concrete Reinforcement

## 1.3 REFERENCES

- A. SSCDOT - Standard Specifications, Department of Transportation, State of California (Caltrans), latest edition, except for references to method of payment, and references to any state furnished materials.
- B. ACI standards, including but not limited to #304, 305, 306, 308, 309 and 347.
- C. ASTM standards, including but not limited to #C-33, C-39, C-94, C-136, C-143, C-150, and C-309.

## 1.4 SUBMITTALS

- A. Submit under provisions of Specification Section SUBMITTALS.
  - 1. Certificates of compliance for materials and mix designs.
  - 2. Load tags for delivered material.
  - 3. Strength testing as required by the approving agency.
  - 4. Integral color sample, where applicable.

5. Application instructions for the architectural finish materials.
6. Accessories and manufacturer's installation specifications.

## 1.5 QUALITY ASSURANCE

- A. Furnish concrete materials conforming with SSCDOT.
- B. Perform work in accordance with SSCDOT, unless noted otherwise herein.

## PART 2 - PRODUCTS

### 2.1 MIXES

- A. Mix Design and Proportions in accordance with SSCDOT:
  1. Mix designs with Fly Ash content no greater than 15 percent of the total weight of cementitious materials shall be proportioned by SSCDOT.
  2. Provide a maximum of 4 percent air entrainment, unless noted otherwise.
  3. Owners Testing laboratory shall review all mix designs before submittal.
  4. All concrete shall have the following minimum compressive strengths in accordance with ACI 318 and SSCDOT at 28 days and shall be proportioned within the following limits:
    - a. Site Concrete: Use for exterior concrete slabs on grade including, but not limited to sidewalks, curbs, gutters, mow strips, utility appurtenances and miscellaneous site improvements.
 

1) Strength:	3,000 psi at 28 days
2) Maximum Aggregate Size:	1-inch
3) Cement Type:	Type II/V
4) Cement Content:	5.5 sacks/yd minimum
5) Max Water/Cement Ratio:	Per SSCDOT
6) Admixture:	Per SSCDOT
7) Slump	4"±1"
    - b. Structures & Vehicular Concrete Paving: Use for site structures, backstop wall, and exterior slabs on grade subject to vehicle traffic or denoted as *heavy-duty concrete* in the plans
 

1) Strength:	4,000 psi at 28 days
2) Maximum Aggregate Size:	1-inch
3) Cement Type:	Type II/V
4) Cement Content:	6.5 sacks/yd minimum
5) Max Water/Cement Ratio:	Per SSCDOT
6) Admixture:	Per SSCDOT
7) Slump	4"±1"
    - c. Slurry Backfill: Use for backfill of over-excavated trenches, encasement of all penetration, and site utility piping.
 

1) Maximum Aggregate Size:	3/8-inch
2) Cement Type:	Type II/V
3) Cement Content:	2.0 sacks/yd minimum
- B. Reinforcement shall comply with relevant portions of Division 32 Specification Section CONCRETE REINFORCEMENT.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Subgrade shall conform to the requirements of Division 31 Specification Section EARTHWORK: EXCAVATION, FILLING AND GRADING. The District may elect to verify compacted subgrade elevations by measurement made from adjacent existing improvements or by a template supported by forms.

### 3.2 GENERAL CONCRETE

- A. Concrete placement shall conform to the applicable requirements of Standard Specification Sections 51 and 90. Concrete shall not be placed when the air temperature in the shade at the project site exceeds 95° F or is below 45° F, or when the temperature of the concrete exceeds 85° F.
- B. After the concrete has been placed, it shall be struck off to proper section and compacted with a grid of parallel metal bars until a layer of mortar not less than 3/8 inch thick has been brought to the surface. All exposed concrete surfaces shall receive a medium broom finish applied transversely to the line of pedestrian traffic or to the longest dimension of the concrete, as applicable.
- C. General concrete surfaces shall be cured by the curing compound method and shall be protected in accordance with the provisions of Subsections 90-1 and 90-2 of the Standard Specifications.

### 3.3 PROTECTION OF CONCRETE

- A. The Contractor shall be responsible for the condition of all concrete work until such time as all work has been completed and is accepted by the District. The Contractor shall limit vehicular travel across concrete until such time as the concrete has achieved strength sufficient that it can support traffic without damage. In no case, however, will vehicles be allowed to travel across new concrete improvements until seven calendar days have passed since the concrete was placed.

### 3.4 CONCRETE JOINTS

- A. Expansion joints and weakened plane joints shall be constructed at the locations shown on the plans or as directed by the Engineer. Where joint locations are not specified on the plans, expansion joints shall be constructed at maximum intervals of 15 feet in each direction for 5-inch-thick slabs, and weakened plane joints shall be constructed at maximum intervals of 10 feet.
- B. Expansion joints shall be considered as weakened plane joints for the purpose of spacing weakened plane joints. Expansion joints shall be tooled with a 1/4 inch maximum radius edger, and shall be filled with 3/8 inch pre-formed expansion joint filler.

### 3.5 CONCRETE FINISHES

- A. Where concrete is being installed adjacent to or near existing concrete improvements, match the finish of similar concrete surfaces (i.e. new sidewalks shall match existing sidewalks, new curbs shall match existing curbs, etc.).
- B. Sidewalks and Mowstrips: Medium sweat finish or medium broom finish perpendicular to the direction of travel.
- C. Curbs: Trowel smooth and finish with a light brush.
- D. Gutters: Medium broom finish parallel with curb or direction of flow.
- E. Drive approaches and wheelchair ramps: medium broom finish, perpendicular to the direction of travel.

### 3.6 INSTALLATION OF ACCESSORIES

- A. Strictly comply with manufacturer's instructions and recommendations and approved details. Securely anchor work to substrate.

### 3.7 REPAIR AND CLEAN-UP

- A. Contractor shall legally remove all trash, debris, containers and excess materials from the site on a periodic basis, and shall keep the work broom clean until Owner's acceptance.
- B. The Contractor shall be held responsible for the repair and/or replacement of new or existing improvements damaged as a result of this work to the satisfaction of the Owner.
- C. The Contractor shall provide roll-off bins for wash-out of ready-mix concrete trucks and pumps. Do not allow concrete debris or cement water onto soils scheduled for landscape planting.

END OF SECTION



## SECTION 32 13 15 - CONCRETE REINFORCEMENT

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY:

- A. This Section includes the following:
  - 1. Deformed reinforcing bars for site concrete improvements.
- B. RELATED SECTIONS
  - 1. Contract General Conditions and Division 1, General Requirements
  - 2. Section 32 13 13 - Site Concrete Improvements.

## 1.3 SUBMITTALS

- A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.
  - 1. Mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered. If mill test reports are not available and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove yield strength and bending.
  - 2. Drawings and placing diagrams for each grade slab including dowels and corner bars.
  - 3. On the placing diagrams, show all openings for pipelines and architectural features. Include additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings.
  - 4. Coordinate placing diagrams with the concrete placing schedule.

## 1.4 PRODUCT DELIVERY

- A. Deliver reinforcement to project site in bundles marked with tags indicating bar size and length.
- B. Store on wooden supports above ground surface.

## PART 2 - PRODUCTS

## 2.1 BARS

- A. Bars shall be deformed billet steel conforming to ASTM A 615, Grade 60. Mixing of steel grades will not be allowed.

## 2.2 BAR SUPPORTS

- A. Bar support shall be concrete or metal chairs, spacers or hangers. Reinforcing bars shall not be supported by forms.

## 2.3 TIE WIRE

- A. Tie wire shall be annealed steel wire of not less than 16-gauge.

## PART 3 - EXECUTION

## 3.1 PLACEMENT

- A. Position reinforcement in accordance with the drawings, secure with wire ties or suitable clips at all intersections, and support by an adequate number of concrete or metal chairs, spacers, or metal hangers such that reinforcing bars do not sag more than one quarter of an inch (1/4") between supports. Do not place reinforcement or supports in contact with the forms. Bend tie wires away from the forms in order to provide the specified concrete coverage. To secure reinforcement in position, the Contractor may elect to locate bars additional to those shown on the drawings, but at no additional cost to the Owner.
- B. Set reinforcing dowels and anchor bolts in place prior to placing concrete. Do not press them into the concrete after the concrete has been placed.
- C. Splice bars only at locations shown on the drawings. Where splices are not detailed, lap bars 72 bar diameters.

## 3.2 CLEANING

- A. Remove dirt, form oil, excessive rust, cement coating from previous pours, and foreign matter that will reduce bond with concrete.

## 3.3 PROTECTION DURING CONCRETING

- A. Keep reinforcing steel in proper position during concrete placement.

END OF SECTION

## SECTION 321540 - CRUSHED STONE SURFACING

## PART 1 - GENERAL

## 1.1 DESCRIPTION

- A. Furnish and install decomposed granite surfacing which includes:
  - 1. Sub-grade Preparation
  - 2. Base Preparation
  - 3. Edge restraint
  - 4. Stabilizer
  - 5. Compaction
  - 6. Cleanup
- B. Related work:
  - 1. Section 312200: Earthwork
  - 2. Section 312222: Soil Materials
- C. Definitions: The word Architect as used herein shall refer to the Landscape Architect or the Owner's authorized representative.

## 1.2 SUBMITTALS:

- A. Procedure: Submittals shall be provided in accordance with Division 01 requirements.
- B. Submit aggregate sieve analysis, product specifications and a one pint representative sample of the proposed decomposed granite, with named source.

## PART 2 - PRODUCTS

## 2.1 DECOMPOSED GRANITE

- A. Decomposed granite is referred to by the abbreviation (D.G.), or referred to as disintegrated granite. All decomposed granite for non-vehicular surfaces shall conform to the following grading requirements:

Sieve Designation	% Passing
3/8 inch	100
No. 4	90-100
No. 8	75-80
No. 16	55-65

Sieve Designation	% Passing
No. 30	40-50
No. 50	25-35
No. 100	15-20
No. 200	10-15

- B. The portion of D.G retained on the no. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96.
- C. The portion passing a No. 40 sieve shall have a maximum liquid limit of 25 and maximum plasticity index of 7 as determined by AASHTO T89 and AASHTO T90, respectively.
- D. The sand equivalent shall be in the range of 35-55. The R-value shall be a minimum of 71.
- E. Crushed aggregate screenings shall be free from clay lumps, vegetative matter and deleterious material.
- F. D.G. shall be grey in color.

## 2.2 SOIL BINDER

- A. Binder shall be a non-toxic, colorless, odorless, organic powder that binds D.G. screenings consisting of 95% Psyllium with a minimum 70% Mucilliod content. The binder shall be "Stabilizer" as manufactured by Stabilizer Solutions Inc., (800) 336-2468, FAX: (602) 225-5902, or equal.

## 2.3 EDGING

- A. Aluminum edging: 3/16" x 5 1/2", manufactured from 6063 extruded aluminum alloy of T-6 hardness with interlock system and 5 stake punch outs fabricated in each strip. Stakes 12" long, lock 1/2" below top of edging.
  - 1. Finish: Black anodized

# PART 3 - EXECUTION

## 3.1 SUBGRADE AND DECOMPOSED GRANITE PREPARATION AND COMPACTION

- A. Subgrade under all D.G. shall be scarified to a minimum depth of 12", graded and compacted to 90% maximum dry density (relative compaction).
- B. Minimum compaction for pedestrian use D.G. surfaces shall be 85% maximum dry density (relative compaction), and 90% maximum dry density (relative compaction) for vehicular use. The Contractor shall provide one compaction test for every 2,000 square feet or fraction thereof.
- C. The finish grade shall be even between the headers with no humps or depressions greater than +/- 0.25" after the compaction.

## 3.2 SOIL STABILIZER AND DECOMPOSED GRANITE INSTALLATION

- A. Soil stabilizer shall be thoroughly mechanically blended per the manufacturer's recommendations with the D.G. screenings prior to transport to the job site.
  - 1. For vehicular and/or pedestrian use, the stabilizer shall be mixed at a minimum rate of 15 lbs. of Stabilizer product per ton of D.G. aggregate.
  - 2. For tree well use, the stabilizer shall be mixed at a minimum rate of 8 lbs. of Stabilizer product per ton of DG aggregate.

3. Premixed Stabilizer and D.G. material can be obtained locally by contacting the stabilizer manufacturer and obtaining the location of a local vendor.
  4. Drop spreading of the Stabilizer product over raked D.G. screenings and mixing stabilizer by rototilling is NOT ACCEPTABLE.
- B. Place the premixed stabilizer product on the pre-soaked subgrade in maximum 2" lifts. Rake smooth to the desired grade and cross slope.
- C. After placement and raking, water the Stabilized D.G. to achieve full depth moisture penetration of the placed product. Apply 25 – 45 gallons per ton to achieve the proper full depth moisture penetration.
- D. After 6 – 72 hours for activation, roll the Stabilized D.G material with a 2 to 5 ton double drum roller to achieve finish grade and initial compaction without separation, plowing or any other physical compromise of the aggregate. Utilize a hand tamp at edges, around benches, and sign posts. Do not use a vibratory wacker plate or vibratory roller to compact the Stabilized D.G.
- E. Finish surface elevation:
1. Compacted finish surface of DG shall be flush with headers, paving, mowstrips and/or curbs, unless otherwise indicated.
  2. Compacted finish surface of DG shall be two inches above finish grade in adjacent shrub/ground cover planting areas, unless otherwise indicated.
  3. Compacted finish surface of DG shall be one-half inch above finish grade in adjacent sodded turfgrass planting areas, unless otherwise indicated.
  4. Compacted finish surface of DG shall be flush to finish grade in adjacent seeded or sprigged turfgrass planting areas, unless otherwise indicated.
- F. Lightly spray the surface after compaction operations. Allow the finished surface sufficient time to dry prior to use.
- G. Finished surface shall be smooth, uniform and solid with no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material shall not be present on surface after installation, but may appear after use and according to environmental conditions. Pathway shall remain stable underneath loose granite on top with a "natural" look. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

### 3.3 CLEANUP

- A. After all stabilization operations are completed, remove trash, excess materials, empty containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a smooth condition throughout the site.
- B. The D.G. surface shall be dragged and a final dressing performed within 48 hours prior to final acceptance.

END OF SECTION

## SECTION 32 17 23 – PAVEMENT MARKINGS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. Furnishing and installing paint parking stall, traffic marking and wording on asphalt concrete surfaces.
- B. Furnishing and installing disabled marking and hatching area on asphalt concrete pavement.

## 1.2 RELATED SECTIONS:

- A. Section 32 12 17 – Asphalt Paving.
- B. Section 32 13 13 – Site Concrete Improvements.
- C. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to the work of this section.

## 1.3 REFERENCES

- A. SSCDOT Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment and to furnishing of materials by State.

## 1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Certificates of compliance for materials.

## 1.5 COORDINATION

- A. Coordinate work with other work, including associated traffic signing.
- B. Commence striping or marking of asphalt concrete no sooner than 7 days following any sealing of the asphalt concrete.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Paint: Quick drying, high visibility water soluble acrylic striping paint; Stripe Master, Wikel Mfg. Company, or similar by Sherwin Williams, J.E. Bauer, or PPG, or approved equal.
- B. Paint shall be of color indicated on the construction plans.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that site is ready for application.

#### 3.2 PREPARATION

- A. Identify installation locations. Place parking stall striping, traffic marking, wording, disabled symbol and access striping at locations, as shown on construction plans.
- B. Thoroughly clean all surfaces to be painted.
- C. Employ equipment and methods appropriate to the work site.
- D. Provide vehicular and traffic controls per Division 01.

#### 3.3 INSTALLATION

- A. Apply paint striping and marking as indicated on the plans.
- B. Apply paint uniformly, straight and true, with equipment designed for traffic striping and marking applications.
- C. Apply paint striping and marking per Section 84 of SSCDOT, except supply paint conforming to 2.1 A. of this specification.
- D. Apply a minimum of 2 separate coats of paint at all striping and marking locations, including asphalt concrete and concrete surfaces.
- E. Paint international symbol of accessibility at the location as shown on the plans.
- F. Paint accessible access area striping at the location as shown on the plans.

#### 3.4 FIELD QUALITY CONTROL

- A. Field inspection will be performed under provisions of Division 01.

END OF SECTION

## SECTION 32 18 39 - TRACK SURFACING &amp; MARKINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Full knowledge and understanding of all drawings, specifications, and general provisions of the bidding documents and related in-ground equipment is required by the Track Surfacing Contractor (TSC).
  - 1. This section covers all labor and materials required to install a synthetic track and field surface.
  - 2. The General Contractor (GC) is responsible for the installation of the track sub-base, drainage systems and asphalt base for conformance with CCCAA/NCAA requirements and as detailed in the project drawings and these specifications.
  - 3. The TSC is responsible for assessing the condition of the existing and new sub-base, and installing all synthetic-surfacing materials as designated in the project drawings and these specifications.
  - 4. The TSC is responsible for all line markings required for CCCAA/NCAA track and field events as directed by these specifications and the Owner.
  - 5. The GC is responsible for the purchase and installation of all in-ground track and field equipment including covers at vault boxes.
  - 6. The GC is responsible for the purchase and installation of jump pit covers, and the TSC shall install the track surfacing on the cover panels.

## 1.2 RELATED SECTIONS

- A. Section 321313 – Site Concrete Improvements.
- B. Section 321217 – Asphalt Pavement.

## 1.3 CODES AND STANDARDS

- A. Codes and standards follow the current guidelines set forth by the California Community College Athletic Association (CCCAA) and the National Collegiate Athletic Association (NCAA).

## 1.4 SUBMITTALS

- A. The following information shall be submitted by the TSC with the bid documentation:
  - 1. Standard printed specifications of the synthetic surfacing system that is being installed.



2. Surface tolerance requirements for the asphaltic concrete and concrete base, and any conditions that may limit the sports installation, or affect quality of installation.
  3. Temperature / climatic conditions limiting quality of installation.
  4. The track surface will be applied by a licensed firm, which has successfully installed the polyurethane material included in the specification for the past five (5) years. The contractor shall submit documentation of a current California license, bond number as well as a current sales tax and use tax number.
  5. Polyurethane materials used must meet all EPA and California VOC standards.
- B. The following information shall be submitted by the TSC to the Owner prior to installation:
1. Provide a minimum five (5) year manufacturer's warranty against workmanship, installation and materials on the synthetic track surface.
  2. The TSC installing the material shall submit an affidavit attesting that the surfacing material to be installed meets the requirements defined in the manufacturers currently published specifications and any modifications outlined in these technical specifications prior to the commencement of any work.
  3. A letter signed by an authorized representative of the TSC, that the track and field surfacing has no measurable traces of heavy metals, leachable mercury, and any other hazardous materials identified by the EPA.
  4. A product sample 6" x 6" in size, the same colour, texture, thickness, etc. as the type of surfacing to be installed for this project. This must be a representative sample of the product for comparison of color and texture during installation. This sample must be submitted and approved by the Owner prior to installation.
  5. A Striping plan showing all lane lines and numbers, starting and finish lines, relay zone lines and other lines and marks required for NFHS standards clearly identified and color coded.

#### 1.5 QUALITY ASSURANCE

- A The synthetic track surface shall be installed by authorized applicators of the approved manufacturer, acceptable to the Owner. The Owner reserves the right of final acceptance with regards to any crewmembers of the TSC.
- B. Each bidder shall be fully acquainted with the existing facility and utilities and shall fully understand the difficulties and restrictions attending the execution of the work under contract. All bidders shall advise the Owner before submitting bids of any restrictions or anticipated difficulty.
- C. All material shall be guaranteed to the extent that the surfacing:

1. Has been manufactured and applied in accordance with these and the manufacturer's specifications.
  2. Will hold fast and/or adhere to the asphalt, concrete, edging, filler and patches or overlay materials.
  3. Will perform as specified in these specifications and the specifications of the product manufacturer in the current standard product information literature and specification sheets.
  4. Is Ultra-Violet resistant and will not de-laminate, bubble, blister, fade, crack or wear excessively during the guarantee period.
- D. All machinery and materials used must be only those approved by the Owner and the approved manufacturer of the selected synthetic surfacing material.
- E. Request for deviations or substitutions from the specifications must be made in writing seven days prior to the bid date. Complete product data including specifications, application rates, mixing instructions and a sample shall be sent with the request to the District and/or its agent for an evaluation. Alternatives will be allowed only by addendum.
- F. Contractor references for five (5) similar, successfully executed projects will be required. Successful contractor will provide proof of insurance as well as performance and payment bonds if required.

#### 1.6 SPECIAL PROJECT CONDITIONS

- A. Any required drainage and base works are the responsibility of the GC. The GC will provide a technician on-site during sub-contract installations through the completion of the contract.
- B. The TSC will provide a technician who will review the asphalt specification as supplied by the GC and accepting that the specification is acceptable, shall verify the suitability of the asphaltic concrete pavement based on information provided by the GC after installation.
- C. Weather: Surfacing shall not be done when the threat of freezing exists for the following 24 hours, rain is imminent or gusting winds are occurring.
- D. While surfacing and striping are being done, sprinkler systems must be curtailed, shut off, or controlled so that no water falls on the track or event area surfaces. Other trades and District personnel must stay off the wet or curing surfaces.
- E. Do not apply rubberized topping when base surface temperature is less than 40 degrees F.
- F. Provide temporary barriers as required to prevent public entry to construction area and to protect adjacent surfaces from contamination and/or damage during construction operation.
- G. Keep all personnel, other than employees of track installer, 100 feet from equipment and workers.

## 1.7 SPECIFIC SCOPE OF WORK

- A. At the completion of the construction of the track and field base, the GC shall supply to the TSC a topographic survey confirming that the elevations/slopes of the base meet the rules/requirements of the sport and/or the specifications and to show that the track and field areas will meet the rules of the sport. The GC will provide adequate test results verifying that the installed asphalt meets the required specification. The asphalt testing and topographic survey cost is the responsibility of the GC.
- B. The TSC shall provide all labor, materials and equipment to perform the following work:
  - 1. Review Bidding documents and specifications, verify suitability of installation of, by GC's sub-contractors, the base and the in-ground track and field equipment.
  - 2. Sufficiently clean down all areas to be surfaced, and protect all areas not to receive synthetic surface.
  - 3. Install approved synthetic surfacing material on all areas as defined by the Bidding documents.
  - 4. Install approved finish coat as defined by project specifications
  - 5. Install synthetic surfacing to pole vault box covers, long/triple jump blanking boards, sand pit covers, and miscellaneous boxes and covers.
  - 6. Stripe all line markings as required with 2 coats approved line paint. Provide painted track graphics, text and numbers as shown in the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 APPROVED MANUFACTURES

- A. Reckortan®-S/Sprutan BV as manufactured by Advanced Polymer Technology.
- B. BSS 300 as manufactured by Beynon Sports Surfaces.

### 2.2 PRODUCTS AND MATERIAL DESCRIPTION

- A. Running Track Surface: Polyurethane bound impermeable sandwich system with a SBR base mat. Mat is sealed with two-component flow in place polyurethane and finished with a flow applied two-component colored polyurethane layer with an EPDM broadcast finish. Total thickness of finished product shall be an average of 14mm (1/2") in thickness.
- B. Rubber (SBR): Base mat rubber shall be specifically graded Styrene Butadiene Rubber (SBR). Final gradation is to be 1.0-3.0 mm, granulated SBR. SBR is to be dried to less than 2.5% moisture and sealed in bags.
- C. Colored Rubber (EPDM): Top coat of rubber shall be synthetic Colored EPDM, same color as liquid polyurethane VPU. Final gradation is to be 1-3 mm.

Colored Rubber	
Basic Material EPDM	20%
Hardness	Shore A 64±1

Specific Gravity (S.G.) 1.53±.02

Black rubber is NOT allowed in wearing course. Color: To be selected by the owner

- D. Base Mat Binder: Base mat shall be bound by moisture-cured liquid polyurethane, compatible with base mat rubber. No asphaltic emulsions or epoxies are allowed in Base mat.
- E. Matt Sealer: Basemat shall be sealed using a two component polyurethane mat sealer. Product per manufacturers recommendations.
- F. Full Pour Layer: Full pour layer polyurethane shall be a two component VPU polyurethane compound from polyols and isocyanate based on MDI with no solvents or filler added. No product shall be considered an equal if polyol to isocyanate mic ratio exceeds 3 to 1.
- G. Wearing Course Layer: Colored EPDM rubber is to be bound by same two component polyurethane as full pour layer. Color shall be selection by the owner
- H. Striping and Marking Paint: Metalatex Semi Gloss acrylic paint manufactured by Sherwin Williams or equal, which is California VOC compliant and compatible with track surfacing material.
- I. Encapsulation Coat: Aliphatic pigmented waterborne polyurethane coating, Beypur 160, or approved equal

### PART 3 - EXECUTION

#### 3.1 INSTALLATION REQUIREMENTS

- A. The GC is to purchase and install all in-ground track & field equipment.
- B. The TSC is to purchase and install all synthetic surfacing, including plugs for any pole vault boxes, take-off boards, and install surfacing on all junction boxes or yard boxes located in the track surfacing area.
- C. The following installation requirements must be met by the TSC:
  - 1. The TSC is required to follow the operations listed under Section: Specific Scope of Work.
  - 2. Installation by approved technicians. Local laborers may be hired for non-technical work, only.
  - 3. Technical representative from the approved manufacturer of the synthetic surfacing must verify the suitability of the installation of the asphalt base for the track and field surface prior to starting installation.

#### 3.2 TIMING, LIMITATIONS, AND CONDITIONS AFFECTING INSTALLATION

- A. Weather and Climate: If in the opinion of the synthetic track surfacing manufacturer or the Owner, weather and climatic conditions are having or will have an adverse effect on installation, work shall be delayed until the adverse condition has passed.
- B. Adjacent and Concurrent Construction: Installation shall not take place until the completion of adjacent or concurrent construction operations which generate dust, airborne abrasives, or any other by-product that, in the opinion of the Owner or synthetic track surfacing manufacturer, would be harmful to the track material.
- C. Verify asphalt concrete and concrete paving for dimensional accuracy, surface stability, and surface preparation. Notify the owner of any deficiencies.
- D. It is the responsibility of the GC to water flood the surface receiving the track surfacing with the use of a water truck. If after 30 minutes on a 70 degree F day, 'bird bathes' are evident in a depth more than 1/8", the GC, paving contractor, track surfacing contractor and the Owner's representative will determine the best method of correction.
- E. Entire surface shall be clean and free of all dirt, oil, grease or any other foreign matter. It is the responsibility of the surfacing contractor to thoroughly clean and /or pressure wash all area of the new /and existing asphalt or concrete base as necessary to ensure adhesion of the track surface.
- F. Minimum curing time for base prior to beginning of surfacing is 21 days for new asphalt paving and 28 days for new concrete, unless lesser curing times are accepted in writing by the track surfacing contractor. No concrete curing compounds or asphalt sealers are allowed.
- G. Beginning installation stipulates track installer "accepts" existing conditions. Adhesion to the existing asphalt is the surfacing contractor's responsibility.

### 3.3 APPLICATION PROCEDURES

- A. The entire surface shall be clean and free of dirt, oil, grease or any other matter upon arrival of the installation team. Any dirt, etc. shall be pressure washed off the base by the general contractor.
- B. Prime entire surface area with a compatible polyurethane primer.
- C. Base mat is to be applied at a rate of 16.0 lbs. of SBR rubber mixed with 3.0 lbs. of polyurethane binder per square yard to provide a base mat with a total weight 19lbs./sq. yd. And a 10 mm. minimum thickness before application of seal coat and wearing layer. Installation of base mat is to be done in one lift with use of a paving machine that is specifically designed for this type of project.
- D. Before application of full pour polyurethane seal coat the mat is to be "choked off" using a fine mesh EPDM rubber applied into the mat at a minimum rate of 1 lb./sq. yd.
- E. The seal coat of two-component polyurethane is then applied at a rate of 3.0lbs./sq. yd. to the base mat and spread with a rubber squeegee. THE TWO COMPONENTS OF THIS

MATERIAL MUST BE MIXED BY A COMPUTERIZED ELECTRONIC PROPORTIONING MACHINE THAT CONSTANTLY MONITORS THE MIX RATIO. NO HAND MIXING OF COMPONENTS IS ALLOWED.

- F. Joint edges in the base mat shall be primed with a binding agent prior to laying the adjacent base mat. Joints shall be troweled smooth and flush, without any noticeable visual or surface indentations or changes in surface plane.
- G. Top coat shall consist of a flow-applied layer of two-component polyurethane and an embedded EPDM granular finish. Polyurethane coat is applied to a minimum rate of 6.0 lbs./sq. yd. to achieve a minimum depth of 3mm. onto which pigmented EPDM rubber granules are broadcast into it at a rate of approximately 7.5 lbs./sq. yd., prior to initial cure. After cure is complete excess rubber granules are removed by means of a mechanical sweeper. Remaining EPDM granulate in surface is measurable at a rate of 6 lbs./sq. yd. Depth of wearing coat shall be a minimum of 4mm. for a total thickness of a minimum of 14mm. (Measured to the top of the embedded rubber).
- H. Encapsulation Coat: Apply two applications of aliphatic pigmented waterborne polyurethane coating.
  - 1. The encapsulation coat texture shall be a minimum weight of 0.6 pound per square yard and shall be applied in a minimum of 2 spray applications using equipment specifically deigned for the applying of synthetic track surfaces
  - 2. The 2 spray layers shall be sprayed in opposite directions to achieve a uniform application. Total pound per square yards of the 2 spray coats shall be a minimum 1.1.
  - 3. The encapsulation coat shall be processed and installed by specifically designed machinery with automatic electronic portioning, which provides continuous mixing, feeding, and finishing for accurate quality-controlled installation
  - 4. No hand mixing shall be allowed

### 3.4 LINE MARKINGS

- A. General line markings of the track and field events as shown and/or listed on the project plans, shall be spray applied using only paint, primers and finishes supplied and guaranteed by the approved manufacturer and/or supplier.
- B. All markings shall be spray applied under the direction of a qualified line marker, having marked a minimum of 20 track and field facilities, which meet the CCCAA/NCAA rules and regulations. The line marker shall be approved by the TSC and experienced in the layout of track and field markings.
- C. All striping and markings shall be in accordance with the rules of the CCCAA/NCAA, and shall hold to allowed tolerances.
- D. At the completion of striping, a certificate attesting to the accuracy of all markings and distances conforming to the CCCAA/NCAA rules shall be provided to the Owner.

### 3.5 CLEAN UP

- A. Upon completion of the work, remove all containers, surplus materials and installation debris. Leave the area of work and surrounding areas in a clean, safe and orderly condition, ready for Owner's immediate use contingent upon Final Acceptance.

END OF SECTION

## SECTION 32 28 52 – PARKING LOT FURNITURE

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Furnish and install signs, posts and concrete wheelstops

## 1.2 RELATED SECTIONS

- A. All Division 01 Specification Sections
- B. Section 32 12 17 – Asphalt Paving
- C. Section 32 13 13 – Site Concrete Improvements.

## 1.3 REFERENCES

- A. SSCDOT Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment.
- B. CBC – California Building Code, latest edition.

## 1.4 SUBMITTALS

- A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES.

## 1.5 COORDINATION

- A. Coordinate work with Owner's personnel.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Signs: As per detail drawing and MUTCD standards.
- B. ADA Accessible Signs: As per detail drawing.
- C. Sign Posts: 2 inch diameter galvanized iron pipe, A 120, Schedule 40, unless otherwise shown on drawing.
- D. Concrete for Sign Footings: Specification Section - SITE CONCRETE IMPROVEMENTS
- E. Wheelstop: 3 or 4 feet long pre-cast concrete per detail drawing.



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify existing and proposed site conditions.

#### 3.2 PREPARATION

- A. Identify installation locations.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Employ equipment and methods appropriate to the work site.

#### 3.3 INSTALLATION

- A. Install all sign posts straight and plumb in concrete footings as shown on plans.
- B. Secure all signs to posts with vandal resistant galvanized hardware furnished by the Contractor.
- C. Orient direction of all signs as indicated on the plans.
- D. Install concrete wheelstops at locations shown on drawings. Anchor each wheelstop with two deformed reinforcing bars driven into the asphalt concrete pavement per detail drawing.

#### 3.4 FIELD QUALITY CONTROL

- A. Field inspection will be performed under Division 01.

END OF SECTION

## SECTION 32 31 13 – CHAIN LINK FENCING

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes

1. Provisions of constructing chain link fence at locations shown on the Construction Documents, including but not limited to:
  - a. Site chain link fencing and gates.

## B. RELATED SECTIONS

1. Contract General Conditions and Division 01 Specifications.
2. Section 312000 – Earthwork: Excavation, Filling, and Grading
3. Section 321313 – Site Concrete Improvements.

## 1.2 QUALITY ASSURANCE

## A. Qualifications of Installer

1. Throughout the progress of installation of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.
2. In actual installation of the work of this Section, use adequate numbers of skilled workmen to insure installation in strict accordance with the contract documents.
3. In acceptance or rejection of work performed under this Section, the Engineer will make no allowance for lack of skill on the part of the workmen.

## 1.3 PRODUCT HANDLING

## A. Protection

1. Use all means necessary to protect the materials of this Section before, during and after installation, and to protect the work of other trades.

## B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction of the Engineer and at no additional cost to the Owner.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. The materials and fabrication of chain link fabric shall conform to these specifications, and as shown on the plans and details.
- B. All ferrous materials shall be new and galvanized. Imperfectly galvanized material or material upon which serious abrasions of the galvanizing occur shall not be used.
- C. Height - all fencing shall stand at the heights shown on the plans.
- D. Fabric
  - 1. Standard: Chain link fabric shall conform to ASTM, designation: A392, Class 1. The wire used in the manufacture of the fabric shall be 9-gauge. All chain link fabric shall be woven into approximately 2-inch mesh. Fabric shall be furnished with knuckling at all selvages. The knuckled selva shall be used along all corners and edges. Fabric shall be GBW, galvanized before weaving.
- E. Posts, braces and gate frames
  - 1. The base material for the manufacture of steel pipe used for posts and braces shall conform to the specifications of ASTM, designation: A53 Type A, standard weight, Schedule 40, and the base material for the manufacture of other steel sections used for posts and braces shall be good commercial quality weldable steel.
  - 2. All posts, braces and gate frames shall conform to the size and weight designations shown on the plans.
  - 3. All posts shall be fitted with rainproof caps designed so as to fit securely over the top of the posts.
  - 4. All posts shall be of a total length of not less than the depth of the concrete footing as shown on the plans, plus the length required above ground.
  - 5. Posts and braces shall be galvanized in accordance with specifications of ASTM, designation: A123.
  - 6. All horizontal braces shall be attached to posts by approved steel fixtures.
- F. Stretcher bars and other required fittings and hardware shall be steel and shall be galvanized in accordance with the specifications of ASTM, designation: A153.
- G. All swinging gates and walk gates shall be installed with a gate holdback, Trimco 1209HOHA-626. Holdbacks shall be installed in the concrete mowstrip, unless otherwise noted.
- H. Concrete mowstrip shall be in accordance with Section 321313 SITE CONCRETE IMPROVEMENTS.
- I. Walk gates shall be constructed as per detail drawing and in accordance with CBC sections 11B-206.5 and 11B-404.
- J. Drive gate, roll gate and walk gate shall be constructed as per detail drawing.

- K. Non-accessible swinging/ roll gates (MU1 & MU3) shall comply with the following:
  - 1. Have a lockable fork latch.
  - 2. Have heavy-duty malleable iron hinges
- L. Accessible walk gates on an accessible path-of-travel shall comply with the following:
  - 1. "Passage" style gates (AC2) shall have non-keyed "Rhodes" style lever handles on both sides that are operable with a maximum of 5 pounds of pressure.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. All posts shall be set in concrete footings as shown on the plans to within 3 inches of bottom.
- B. All vertical line and end posts shall be braced to the nearest adjacent vertical post with galvanized horizontal braces as shown on the plans.
- C. Welding
  - 1. All welding shall conform to the requirements of the 2022 California Building Code, Chapter 22
  - 2. Where the galvanized surface has been burned by welding, all surfaces of the welded connections shall be thoroughly cleaned by wire brushing and all traces of the welding flux and loose or cracked galvanizing removed. The damaged area and weld shall then be painted in accordance with the following details.
    - a. All galvanized, welded, or damaged surfaces that are to be painted shall first be cleaned by washing with mineral spirit solvent sufficient to remove any oil, grease or other materials foreign to the galvanized coating.
    - b. After washing, all areas shall be roughened by abrasive blasting using an abrasive that is no larger than 30-mesh. Galvanizing shall not be removed by this operation.
    - c. After preparation, all galvanized surfaces that are to be painted shall be covered with one application of zinc dust-zinc oxide primer, federal specification TT-P-641, Type II. The zinc dust-zinc oxide paint shall be applied by spraying to produce a complete covering of the galvanized surface.
    - d. After the application of the zinc dust-zinc oxide paint, one application of pre-treatment, vinyl wash primer, Section 91-2.7 of the state Standard Specifications, shall be applied to such surfaces. The vinyl wash primer shall be applied by spraying to produce a uniform wet film on the surface.
    - e. Such surfaces shall then be covered with two separate applications of white tint base vinyl finish coat, Section 91-2.22 of the state standard specifications, sufficient to completely cover the preceding color. Paint for the first application shall be tinted with a compatible coloring agent to slightly contrast with the color of the second application. After drying for 24 hours, one application of aluminum paint, finish coat, Section 91-2.8 of the state standard specifications, shall be painted on the welded areas.
- D. Perimeter fencing chain link fabric shall be fastened to the outside of the fence.

- E. All fabric shall be stretched and securely fastened to the posts, as follows:
- F. The fabric shall be fastened to end, corner and gate posts with 3/16 inch by 5/8 inch stretcher bars and not less than 1/8 inch by 3/4 inch stretcher bar bands spaced at one foot intervals for whatever widths of fabric are supplied. The fabric shall be fastened to line posts with tie wires or post clips. Tie wires shall be at least 9-gauge (0.148 inch diameter) steel. Post clips shall be at least 6-gauge (0.192 inch diameter) steel. The wire or clip fasteners shall be spaced at approximately 14 inches on line posts, with a minimum of 5 fasteners per 6 foot high post. Top and bottom edges of the fabric shall be secured to each horizontal brace with tie wires or fastened to tension wire with hog rings spaced at 15 inch maximum intervals. Hog rings shall be at least 9-gauge (0.148 inch diameter) steel. Wire ties shall be given at least one complete turn. Hog rings shall be closed with ends overlapping. The distance from the selvage to the braces or top rails shall be 2 inch maximum and shall be fastened to the brace or rail by wire fasteners spaced at approximately 14 inches with a minimum of 8 fasteners per each 10 foot horizontal span.
- G. Construct concrete mowstrip at the width as shown on the plans.

END OF SECTION

SECTION 32 31 19 – DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. This Section includes the following:
  - 1. Decorative metal fences and gates (shop fabricated)
- B. Related Requirements:
  - 1. Division 03 Section “Cast-in-Place Concrete” for concrete setting fence posts.
  - 2. Division 05 Section “Metal Fabrications” for metal fabrications not included in this section.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Include plans, elevations, component details, and attachments to other work. Indicate materials and profiles of each metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative metal fencing and gates similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.

- C. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code – Steel."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code – Sheet Steel."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal fencing and gates in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal fencing and gates by field measurements before fabrication and indicate measurements on Shop Drawings.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements for Gates and Hardware: Pedestrian gates and hardware indicated to be accessible shall comply with accessibility requirements of the 2010 ADA Standards for Accessible Design and the 2019 California Building Code, Chapters 10 and 11B.
  - 1. Gates shall be capable of opening a minimum of 90 degrees.
  - 2. Gates in the open position shall provide a clear opening width of not less than 32 inches.
  - 3. The bottom 10 inches of the push side gates shall have a smooth uninterrupted surface that allows the door to be opened by a wheel chair footrest without creating a trap or hazardous condition.
  - 4. The effort to open gate shall not exceed a 5 pound force applied perpendicular to the face of the gate.
  - 5. Gates shall be openable from the secure side (inside) without the use of a key or special knowledge or effort. Operating hardware shall not require pinching or grasping to operate hardware.
    - a. Gates may be designed for key operation from either or both sides when the gates are not required egress gates as determined by the Architect and the Division of the State Architect.

## 2.2 STEEL AND IRON MATERIALS

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Tubing: ASTM A 500/A 500M (cold formed).
- C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.
- F. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

### 2.3 FASTENERS

- A. Fastener Materials: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating or Type 304 stainless steel.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Post-Installed Anchors: Mechanical fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
  - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM 593, and nuts, ASTM F 594.

### 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

### 2.5 SETTING MATERIALS

- A. Cementitious Material: per Section 31 12 12 Site Concrete Improvements

### 2.6 FABRICATION. GENERAL

- A. Fabricate fence panels in sections to prevent the need for field welding or cutting. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units



for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

1. Components of fabricated items shall not be finished until after fabrication.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- D. Provide necessary brackets to assemble units and to attach other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
- E. Connect members with full-penetrations welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

## 2.7 DECORATIVE METAL FENCING

- A. General: Fabricate decorative metal fencing from steel bars and shaped of sizes and profiles indicated.
  1. Fabricate fence panels in sections to facilitate galvanizing, transportations to the Project Site, and installation.
- B. Fence Height: As indicated on Drawings.
- C. Posts, Rails, and Pickets: Square steel tube sections complying with ASTM A-500 with hot dipped galvanized exterior zinc coating and as follows:
  1. Posts: Posts having a minimum yield strength of 45,000 psi and a minimum size as follows:
    - a. Posts for Fences: 4 inches square x 1/8 inch thickness.
      - 1) Spacing: Nominal 8 feet on center maximum; posts shall be equally spaced on a standard module.
    - b. Posts for Swing Gates: Size as follows:
      - 1) Gates to 48 inches Wide: 4 inches square x 1/8 inch wall thickness.
      - 2) Gates over 48 inches Wide to 96 inches Wide: 6 inches square x 1/4 inch thickness.
      - 3) Gates over 96 inches wide to 144 inches Wide: 6 inches square x 3/8 inch thickness.
  2. Horizontal Rails: 2 inches square x 11 gage (0.120 inch).
  3. Pickets: 1 inch square x 14 gage (0.080 inch).
    - a. Spacing: Nominal 6 inches on center nominal.
- D. Finish: Galvanize and powder coat after fabrication.

## 2.8 SWING GATES

- A. General: Fabricate decorative metal swings from steel bars and shapes of sizes and profiles indicated in Drawings, match characteristics of fence design.
- B. Gate Height: Match adjacent fence panels.
- C. Gate Width: As indicated on Drawings; 32 inches minimum clear width when gate is in a 90 degree open position.
- D. Gate Framing: Hollow tubular steel sections of size, wall thickness, and spacing as indicated on Drawings, not less than 2 inches x 2 inches x 11 gauge (0.120) minimum size).
- E. Rails: Match fence rails.
- F. Pickets: Match fence pickets.
- G. Hinges: Butt hinges or pivots as selected by fabricator; hinges to be sized for not less than twice the weights of the gate and allow the gate to open 180 degrees.
- H. Operating Hardware: Maintenance gates shall be provided with a lockable fork latch; see below for accessible hardware requirements.
- I. Finish: Galvanize and powder coat after fabrication

## 2.9 Accessible Gates (AC1)

- A. Accessible walk gates on an accessible path-of-travel shall comply with the following:
  - 1. Gate latch hardware shall be a keyed "Rhodes" style lever handle with Von Duprin AX99 panic hardware or approved equal.
  - 2. Contractor shall provide a Schlage key cylinders to District's requirements
  - 3. Accessible gates shall have a minimum 10 inch high steel bottom kick plates on both sides of the gate, with cavities capped.
  - 4. Provide Locinox Mammoth self-closing hinges (black) or approved equal.
  - 5. Provide a gate holdback, Trimco 1209HOHA-626. Holdbacks shall be installed in the concrete mowstrip

## 2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plate, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M. Galvanize items after fabrication.
  - 1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
  - 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filling of smooth.

- B. Powder-Coat Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
  - 1. Prepare galvanized metal be thoroughly removing grease, dirt, oil, flux, and other foreign matter.
  - 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
  - 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 2 mils.
  - 4. Color: As selected by Architect from manufacturer's full range.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal fences and gates
- B. Proceed with installations only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Provide anchorage devices and fasteners where needed to secure decorative metal fencing to in-place construction.
- B. Set posts accurately in location alignment, and elevation; measured from established lines and levels.
  - 1. Post Excavation: Drill or hand-excavate holed for posts to diameters and spacings indicated, in firm, undisturbed soil. Footings shall have a diameter not less than 4 times the width of posts and shall extend 6 inches below the bottoms of the post.
  - 2. Post Setting: Set posts in concrete into firm, undisturbed soil. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices. Crown top of exposed concrete to drain water away from posts. Protect aboveground portion of posts from concrete splatter.
- C. Install gate level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary.
- D. Perform cutting, drilling, and fitting required to install decorative metal fencing. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form tight, hairline joints or, where indicted, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

- F. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations by complete refinishing, or provide new units as required.
- G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication. General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.3 ADJUSTING

- A. Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortions, nonalignment, misplacement, disruptions, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

### 3.4 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint exposed areas with same materials as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/ A 780M.
- D. Protect finishes from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- E. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 32 33 10 - TACTILE/DETECTABLE WARNING SURFACE TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

1.2 SECTION INCLUDES

- A. Tactile/Detectable Warning Surface Tile where indicated.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit two tile samples minimum, 6 inch by 8 inch of kind proposed for use.
- C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

1.4 QUALITY ASSURANCE

- A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.

- D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of “Detectable Warning”. Section 11B-406 for “Curb ramps, blended transitions and islands” and Section 11B-705 for “Detectable warnings and detectable directional texture”.
- E. Detectable Warning Texture: Division of the State Architect (DSA Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1, IRs 11B-2, 11B-3 and 11B-4 and the California Accessibility Reference Manual.
  - 1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center spacing of 2.35 inches and corner domes spaced at 0.896 inch from the corner edges of tile. Provide raised truncated domes in a square grid (in-line) pattern.
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on- dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.
- B. Tiles shall be delivered to location at building site for storage prior to installation.

#### 1.6 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.
- B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

#### 1.7 EXTRA STOCK

- A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.

1.8 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
    - b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.
  2. Warranty Period: Five years from date of Final Completion.
  3. Authority: California Building Code Section 11B, Division of the State Architect Interpretation of Regulations (IR) 11 B-2, 11B-3 11B-4.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Engineered Plastics Inc., Armor Tile.
  2. ADA Solutions, Inc., North Billerica, MA.
- B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1, IRs 11B-2, 11B-3 and 11B-4 and the California Accessibility Reference Manual.
1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center spacing of 2.35 inches and corner domes spaced at 0.896 inch from the corner edges of tile; Provide raised truncated domes in a square grid (in-line) pattern.
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on- dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
  2. Detectable Warning Texture (Truncated Domes): Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., North Billerica, or equal.
- C. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
- D. Color: Yellow conforming to Color No. 33538 of SAE AMS-STD-595A. Color shall be homogeneous throughout the tile.

## 2.2 MATERIALS

- A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: W diameter x 1 3/4" long, or manufacturer's recommended fasteners.
- B. Adhesive and Sealant: Manufacturer's recommended adhesive and sealant.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Surface Applied: The following installation instructions shall be used for tactile warning tiles installed at existing concrete surfaces.
  - 1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
  - 2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
  - 3. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Engineer.
  - 4. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Use thin permanent marker. Remove tile when done marking its location.
  - 5. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.
  - 6. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for minimum of 30 days.
  - 7. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
  - 8. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2" width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.
  - 9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
  - 10. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3W using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.



11. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.
12. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.
13. Working in a sequence that will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.
14. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2" from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.
15. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.
16. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.
17. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.
18. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each. If tiles are custom cut to size, and if pre-molded recesses (to receive fasteners) are removed by the cut, then any truncated dome can be center-drilled with a 5 inch through hole, and countersunk with a suitable bit, to receive mechanical fasteners. New holes should be created no closer to the edge of the tile than any of the other perimeter fastener pre-molded recesses. Care should be taken to not countersink too deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.
19. Adhesive or caulking on the surface of the Tile can be removed with Acetone.

B. Wet Set: The following installation instructions shall be used for tactile warning tiles installed at new concrete surfaces.

1. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
2. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
3. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Engineer.
4. Set the tile true and square to the curb ramp area as detailed in the design drawings.
5. Immediately prior to installing the detectable warning surface tile, the wet concrete surfaces must be inspected to ensure that it is clean and free of debris.

6. Do not remove protective plastic covering on detectable warning tile product until tile is installed and concrete is fully cured.
7. Slowly press the detectable warning tile into the wet concrete until the base of the truncated domes is flush with the adjacent concrete. Do not stand on the tile during installation. Tap the detectable tile with a rubber mallet as required to ensure all edges are flush with concrete. Install anchors into wet concrete as specified per manufacturer's recommendation and ensure that the anchors are flushed with the detectable tile surface. Provide weight to the detectable tile surface if "floating" occurs after tile placement. All detectable tile edges shall be flush with adjacent concrete.
8. While the concrete is workable, a 1/8" deep troweled edge shall be installed around the tile perimeter. Finish the concrete as required per specifications. Ensure concrete edge do not have any low areas that collect water.
9. Set the tile true and square to the curb ramp area as detailed in the design drawings.
10. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.
11. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.
12. Remove protective plastic sheeting after all post-installation treatments are complete and the concrete has cured.

### 3.2 CLEANING AND PROTECTING

- A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.

END OF SECTION

## SECTION 32 84 00 - IRRIGATION SYSTEM

## PART 1 - GENERAL

## 1.1 SCOPE OF WORK

- A. Provide all materials, labor, equipment and services necessary to furnish, install and maintain the Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.
- B. Related Work Specified Elsewhere
  - 1. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 01 Specification Sections, apply to work of this section.
  - 2. Section 31 20 00 – Earthwork
  - 3. Section 31 23 33 – Trench Excavation and Backfilling
  - 4. Section 32 90 00 – Landscape Planting
  - 5. Division 26 05 00 – General Electrical

## 1.2 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with the following codes adopted and amended by the authority having jurisdiction. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. The work described in these specifications shall govern in the event that the drawings or specifications call for material or methods of construction of higher quality or standard than required by these codes.
  - 1. California Plumbing Code
  - 2. California Administrative Codes:
    - a. Title 8, Industrial Relations
    - b. Title 19, Public Safety
  - 3. California Electrical Code
  - 4. Standards and Regulations of other agencies, water utility provider, or organizations as listed in this specification relating to products or procedures, e.g. American Society for Testing and Materials.

## 1.3 DEFINITIONS

- A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.
- B. PVC: Polyvinyl Chloride.
- C. Agencies and Organizations:
  - 1. ASTM- American Society for Testing and Materials
  - 2. AWWA- American Water Works Association
  - 3. IAPMO- International Association of Plumbing and Mechanical Officials
  - 4. CEC - California Electrical Code.
  - 5. UL - Underwriter's Laboratories

6. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.

D. Owner: An authorized representative of the Owner or the Owner's authorized consultant.

#### 1.4 QUALITY ASSURANCE

A. The work of this section shall be performed by a single firm experienced in irrigation work and holding a current California Contractor's A or C27 License.

B. Qualifications of Workers

1. The Contractor shall employ skilled workers who are thoroughly trained and experienced in irrigation system installation and who are completely familiar with the specified requirements and methods needed for proper performance of this work.
2. The Contractor shall provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.
3. All irrigation technicians installing two-wire control system shall participate in a manufacturer provided two-wire installation training and obtain a manufacturer's certification prior to the start of the control system installation. Submit the certification documents prior to the start of the control system installation.

#### 1.5 SUBMITTALS

- A. An operational assessment report of any existing irrigation system in the area of work shall be submitted prior to the start of the project's work, including demolition and clearing. See Subsection 1.7.
- B. The Contractor shall submit complete lists of proposed materials and equipment per the Division 01 Submittal Section, including manufacturer's name and model numbers. Only provide additional product data and/or catalog cut sheets if a substitute material or equipment is proposed. No substitution will be allowed without prior written approval.
- C. Shop drawings shall be provided for the layout and description of all equipment assemblies, including dimensions, capacities, and other characteristics as listed in product specifications. Shop drawings for booster pump assemblies shall clearly and neatly indicate the layout of the assemblies and proposed piping in the pump yard, and shall show adjacent equipment, required clearances, walls, fences, piping and other existing permanent improvements affecting the layout. Materials and equipment shall not be ordered until given written acceptance. Equipment or materials installed or furnished without prior approval or acceptance may be rejected and the Contractor shall be required to remove such materials from the site at his own expense.
- D. When specific name brands of equipment and materials are used, they are intended as preferred standards only. This does not imply any right upon the part of the Contractor to furnish other materials unless specifically approved in writing as equal in quality and performance by the Owner. Decisions by the Architect/Engineer shall govern as to what name brands of equipment and materials are equal to those specified on the plans and his decisions shall be final. It shall be the responsibility of the Contractor to furnish proof as to equality of any proposed equipment or material.

- E. Approval of any item, alternate or substitute indicates only that the products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- F. Acceptance of any submittals, deliverables, or other work product of the Contractor shall not be construed as assent that the Contractor has complied with, nor in any way relieved the Contractor of compliance with (i) the applicable standard of care, and/or (ii) applicable statutes, regulations, rules, guidelines, and contract requirements.
- G. Irrigation Equipment: When the Contractor desires to transfer salvaged irrigation equipment and/or new spare equipment and/or parts to the Owner, he must submit along with the equipment an itemized list. The Contractor is solely responsible to obtain a written confirmation by the Owner that all materials received by the Owner matches his material list. The transfer of materials will not be considered executed without written confirmation of same.
- H. Submit any required or requested testing data and/or Certificates, including but not limited to the backflow prevention assembly testing Certificate after the assembly is installed prior to regular system operation.

#### 1.6 EXPLANATION OF DRAWINGS

- A. The intent of the drawings and specifications is to indicate and specify a complete and efficient sprinkler irrigation system ready for use in accordance with the manufacturer's recommendations, and all applicable local codes and ordinances. Interpretation of irrigation plans and specifications shall be the responsibility of the Landscape Architect or Owner.
- B. All existing systems and improvements are shown in their approximate locations. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Owner.
- C. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all his work, and plan his work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, utilities, and architectural features will be avoided. Locate pipe, valves and other equipment in planting areas unless specifically noted otherwise.
- D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically mentioned in the specifications.

#### 1.7 EXISTING CONDITIONS

- A. The Contractor shall not install the irrigation system and equipment as shown on the Drawings when it is obvious in the field that obstructions or differences in existing conditions and/or systems are present. Such obstructions or differences should be immediately brought to the attention of the Owner. Failure to provide notification prior to the start of this work shall make

the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage of the system without any additional cost to the Owner.

- B. The Contractor shall examine carefully the site of work contemplated and the proposal, plans, specifications, and all other contract documents. By submitting a bid, the Contractor attests that he has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantity of work to be performed and materials to be furnished, and the requirements of the specifications. The Contractor shall take necessary precautions to protect existing site conditions that are to remain. Should damage be incurred, the Contractor shall make the necessary repair or replacement to bring it back to its original condition at his own expense.
- C. Prior to cutting into the soil, the Contractor shall coordinate with the Owner to locate all cables, conduits, sewers, septic tanks, and other such underground utilities as are commonly encountered and he shall take proper precaution not to damage or disturb such improvements. If a conflict exists between such obstacles, notify the Owner who will consider realignment of the proposed work. The Contractor will proceed in the same manner if a rock layer or any other condition encountered underground makes change advisable. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.
- D. The Contractor shall verify the correctness of all finish grades within the work area in order to insure the proper soil coverage (as specified) of the sprinkler system pipes. The Contractor shall verify and be familiar with location and size of the proposed water supply (P.O.C.). He shall make approved type connection and install new work.
- E. The Contractor shall be responsible for notifying the Owner prior to installation that equipment or methods indicated on the drawings or in the specifications conflict with local codes, are incompatible or an error is apparent. If the event the Contractor neglects to do this, he will accept full responsibility for any revisions necessary.

#### 1.8 PERMITS

- A. The Contractor shall obtain and pay required fees to any governmental or public agency. Any permits for the installation or construction of any of the work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspections and examination required by these authorities.

#### 1.9 TESTING

- A. General: Unless otherwise directed, tests shall be witnessed by the Owner. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

- B. Main Line Piping: Hydrostatically test main line pipe segments after a minimum of twenty-four (24) hours after any solvent connections. Purge any free air in the test pipe sections. Partially backfill pipe but keep all joints exposed. Maintain 125 psi water pressure in new main line piping for a minimum duration of two (2) hours. There can be a maximum +/- 5psi change in pressure during the test.
- C. After being installed at the project site, any newly installed Backflow Prevention unit must be tested and approved as functioning properly per the local water agency requirements. Approval of the backflow prevention unit must precede any final inspection of the irrigation system. All costs for testing shall be the responsibility of the Contractor.

#### 1.10 OBSERVATION

- A. General:
  - 1. Installation and operations must be approved by the Owner.
  - 2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
  - 3. In all cases, where inspection or observation of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's Representative, the Contractor shall notify the Owner's Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to provide notification of the required inspection or observation, shall be performed at the Contractor's own expense.
- B. Periodic observations shall be required for basic operations and installations during progression of the project. The Owner's Representative, Owner or Landscape Architect shall perform the observations and shall record the observation on the Irrigation System Observation Log form on the As Built Record Drawings. Such observations will include but not necessarily be limited to the following items as included in the scope of work:
  - 1. Layout and flagging of sprinkler heads.
  - 2. Trenching.
  - 3. Main line installation.
  - 4. Main line sustained pressure check.
  - 5. Wire/cable placement and grounding.
  - 6. Partial fill compaction of trenches.
  - 7. Control valve installation.
  - 8. Drip line installation prior to backfilling.
  - 9. Sprinkler/emitter coverage prior to the start of planting operations.
  - 10. Overall system operation and primary/secondary communication.
- C. Coverage & Operations Review:
  - 1. When the irrigation system is operational and prior to soil conditioning operations, the Contractor in the presence of the Owner shall perform a coverage test of the irrigation system. The Contractor shall furnish all materials and labor required to perform the coverage test and to correct any minor inadequacies of coverage disclosed. The Contractor shall inform the Owner and Owner of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such

notification of necessary corrections or additions to the irrigation system is not provided prior to or during the coverage test, the Contractor shall make all subsequent adjustments and corrections needed for proper coverage without any extra cost to the Owner.

2. Prior to the start of the maintenance period, the irrigation system shall be reviewed by the Owner for proper operations, and a review of and training on equipment and associated controls performed. Any corrections and/or adjustment shall be made as a condition for the start of the maintenance period and subsequent Final Acceptance.
3. Submit a Pump Start-up and Training Report after start-up. Include a copy in the O&M manual.

- D. Final Acceptance: The work will be accepted in writing when the entire project improvements have been completed to the satisfaction of the Owner. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary for the Owner to occupy any portion of the work area before the contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's separate work forces.

#### 1.11 REJECTION OF NON-CONFORMING MATERIAL OR WORK

- A. The Owner reserves the right to reject any material or work which does not conform to the contract documents. The rejected material or work shall be removed or corrected by the Contractor at no additional cost to the Owner.

#### 1.12 OPERATIONS AND MAINTENANCE INSTRUCTIONS & RECORD DOCUMENTS

- A. The Contractor shall prepare and deliver to the Owner's Representative within ten (10) calendar days prior to completion of the construction and as a prerequisite to the start of the maintenance period, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals. These manuals shall describe the material installed and shall be in sufficient depth to permit operating personnel to understand, operate and maintain all equipment. Spare part lists and related manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall contain the following information:
1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of equipment, with names and addresses of local manufacturer representatives and warranty periods.
  2. The Contractor to issue a "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions and that the system functions properly.
  3. Complete operating and maintenance instructions and warranties on all major equipment.
  4. Complete set of manufacturer's literature and specifications of material installed, including parts list.
  5. A list of the controller station number for each control valve if different than the control valve number shown on the drawings.
  6. Initial electrical data on each control valve:
    - a. Ohms reading for each valve taken at the controller (circuit is OFF).



- b. Voltage reading for each valve taken both at the controller and at the valve (circuit is ON).
- B. The contractor shall furnish one set of As-Built full-scale drawings on bond, and two compact disks with complete sets of digital PDF files of all close-out documents after the As-Built Record Drawings have been reviewed and accepted by the Landscape Architect.
  1. Label first page of each document, or set of documents, "AS-BUILT PROJECT RECORD" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Prints for this purpose may be obtained from the Owner. This set of drawings shall be kept on the site and shall be used only as a record set. Do not conceal any work until required information is recorded. These drawings shall also serve as work in progress sheets, and the Contractor shall make **neat and legible** annotations thereon daily as the work progresses, showing the work as actually installed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Owner.
  2. Drawings: Legibly mark to record actual construction:
    - a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and depth of each concealed line or item. Accurately locate each capped, plugged or stubbed line.
    - b. Field changes of dimension and detail.
    - c. Changes made by Field Order, Addenda, or other change document.
    - d. Show the final controller station number for each control valve if different than the control valve number shown on the drawings.
  3. Deliver all Close-out Documents (As-Built) to the Owner. Accompany submittal with transmittal letter in duplicate, containing:
    - a. Date.
    - b. Project title.
    - c. Contractor's name and address.
    - d. Title and number of each Record Document (As-Built).
    - e. Signature of Contractor or his authorized representative.
- C. The Contractor shall provide controller chart(s) as follows:
  1. The Contractor shall provide two controller charts for each controller's area of work.
  2. The chart shall show the area of work controlled by the automatic controller and shall be the maximum size that the controller door will allow.
  3. Show the controller station number for each control valve if different than the control valve number shown on the drawings.
  4. The chart may be a reduced drawing of the actual as-built system. However, in the event the valve numbering is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
  5. The chart shall be colored with a different permanent color for each station.
  6. The chart shall be enclosed in a waterproof envelope or laminated.

#### 1.13 SPARE PARTS AND EQUIPMENT

- A. Prior to the conclusion of the maintenance period, furnish the Owner with the following spare parts and equipment:

1. One quick coupler key with attached hose swivel for each set of four quick coupler valves installed.
2. Ten spare nozzles for each different sprinkler head arc and/or radius nozzle installed.
3. One valve key for the 2" operating nut and/or hand cross isolation valve.
4. One hundred feet of in-line emitter tubing with ten straight and ten ninety degree compression fittings.

#### 1.14 WORK AREA AND SAFETY

- A. The Contractor shall furnish, erect, and maintain all temporary facilities; perform all temporary work during the period of construction, including those herein specified. All facilities shall be maintained in proper and safe operating and sanitary conditions at all times.
- B. The Contractor shall comply with the provisions of the Construction Safety Orders, and General Safety Orders issued by the State Division of Industrial Safety, as well as all other applicable laws, ordinances and regulations.
- C. The project site shall be maintained in a neat and safe condition at all times. Cleanup shall be accomplished as the work progresses and upon completion of the work. The Contractor shall provide adequate safety measures to protect workers and the public from injury.

#### 1.15 GUARANTEE

- A. Irrigation system consisting of materials, equipment and workmanship shall be guaranteed for proper operation a minimum of one year from date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later. Manufacturer's warranty periods may be longer, and shall be noted in the close-out documents.
- B. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects of materials, equipment or workmanship one year from the date of Final Acceptance of the Work or the Notice of Substantial Completion of the Project, whichever is later.
- C. The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the Guarantee as herein specified.
- D. The Booster Pump Assembly shall have a minimum 2 year warranty with no-cost annual service checks over the Warranty Period. See the Booster Pump Assembly and Controls execution section for additional requirements.

### PART 2 - PRODUCTS

#### 2.1 PIPE AND FITTINGS

- A. Schedule rated white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1785.

- B. Class rated (Standard Dimension Ratio) white rigid PVC Pipe shall be made from NSF approved Type 1, Grade I, PVC compound conforming to ASTM D-1784.
- C. PVC pipe shall be of the Class or Schedule as follows:
1. PVC pipe shall meet ASTM D-2241 for solvent weld, plain end, ASTM D-2672 for solvent weld, bell end, and ASTM D-3139 for gasketed bell end. Pipe shall be of the Schedule and/or Class as shown on the Drawings.
  2. Pipe sleeves under paving shall be PVC Schedule 40 for 3-inch and smaller or SDR 35 for 4-inch and larger pipes.
  3. Riser and/or manifold pipe connecting valves to main line fittings shall be Schedule 80 PVC.
  4. Pressurized main line pipe shall be Schedule 40, belled end with solvent welds for pipe sizes less than 2 inches. Pipe sized 2 inches and greater shall be Class 200, SDR 21, with gasketed bell ends.
  5. Non-pressurized lateral line pipe shall be Schedule 40, belled end with solvent welds.
  6. All PVC piping shall be purple colored indicating non-potable water use.
- D. All pipes shall be continuously and permanently marked and conform with the following information: manufacturer's name or trademark, nominal pipe size, Schedule or Class of pipe, pressure rating in PSI, ASTM designation and (NSF) seal of approval.
- E. White rigid polyvinyl chloride (PVC) Fittings:
1. Schedule 40 type I and II grade 1, solvent weld socket fittings ASTM D-2466 for all lateral lines.
  2. Schedule 80 type I and II grade 1 solvent weld socket fittings ASTM D-2464 for all main line less than 4 inches diameter.
  3. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable (IPS) schedule, and (NSF) seal of approval.
  4. All plastic fittings and connectors shall be injection molded of an improved polyvinyl chloride compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings. Where threads are required in plastic fittings, these shall be injection molded also.
- F. PVC Solvent Weld Adhesive: All socket and bell type connections shall be joined with primer and PVC solvent cement which shall meet the requirements of ASTM F656 for primer and ASTM D2564, "Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings." Solvent cement joints for plastic pipe and fittings will be made as prescribed by manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for PVC be used in conjunction with a solvent cement designed for the fit of pipe and fittings specified. A heavy bodied, medium set solvent cement, e.g. Weld-On 711 gray, shall be used for all classes and schedules of pipe and fittings.
- G. PVC Pipe Thread Sealant: A non-hardening all purpose sealant and lubricant similar to Permatex #51 or Lasco blue pipe thread sealant which is certified by the manufacturer to be harmless to PVC pipe and fittings. Apply sealant to clean male threads, brushing into grooves and to the first

three threads of the female threads. A good quality grade of teflon tape recommended by the manufacturer for use with plastics may be used in lieu of sealant. Minimum width of tape to be used is 3/4". A minimum of two wraps and a maximum of three wraps to be used.

- H. PVC Swing Joints: Connections to sprinkler heads from lateral lines shall be made with swing joints as detailed. Pre-assembled swing joints from Hunter, King Brothers or Spears are acceptable.
  - 1. Use 6" length nipples for 1/2 inch inlet heads.
  - 2. Use 12" length nipples for 3/4 or 1 inch inlet heads.
- I. Coated ductile iron push-on fittings meeting ANSI/AWWA C110 or C153/A21.10 shall be used for:
  - 1. Main line connections for pipe 3 inches and greater in diameter.
  - 2. New main line service tee at valve connections.
  - 3. Self-restrained fittings shall be used for bell x flange or bell x threaded fittings.
- J. Coated ductile iron service saddles with stainless steel double straps, Romac Industries 202S or equal, shall be used for electric control/quick coupler valve service connections on existing main lines 3 inch or greater.
- K. Galvanized pipe and fittings:
  - 1. Galvanized Pipe shall be hot dip galvanized continuous welded, seamless steel SCH 40 pipe conforming to current ASTM A53 standards.
  - 2. Galvanized Fittings shall be galvanized, threaded malleable iron SCH 40 conforming to current ASTM A865 standards.

## 2.2 BACKFLOW PREVENTION ASSEMBLY

- A. The backflow prevention assembly is existing and shall remain in place.

## 2.3 VALVES

- A. Electric Control Valves:
  - 1. Globe valves operated by low-power solenoid, normally closed, manual flow adjustment. Sizes and types as shown on drawings.
  - 2. Provide a pressure regulating module on all control valves, or other pressure regulating components as part of the operating spray head or low volume head zones when the dynamic system pressure is, or may be greater than 45 psi.
- B. Control Valve Marking: Christy's valve identification tag (or equal), yellow color with text designating controller and valve station number, e.g. "A12", or equivalent.
- C. Isolation Valves:
  - 1. Cast bronze, coated ductile iron or coated cast iron gate valve with resilient wedge, non-rising stem and two inch operating nut. Match size of mainline.
- D. Quick Coupling Valve: Two piece quick coupling valve as shown on the Drawings.

## 2.4 VALVE BOXES

- A. Control Valve/Master Valve/Flow Sensor boxes:
  - 1. All areas: Christy B16 concrete box (11.75" x 22.25") with N16R composite solid flush lid, or equivalent.
- B. Quick Coupler Valve boxes:
  - 1. All areas: Christy F08 round concrete valve box (8" ID) with F08R concrete lid, or equivalent. Boxes in a sports venue's field of play that are noted to be installed below grade shall use a metal lid with a non-woven geotextile of a minimum 0.5 lb./sq. yd. covering the lid and box frame.
- C. Isolation Valve boxes:
  - 1. Gate Valve box in hardscape: Christy G05 round concrete valve box (10.375" ID) with cast iron G05C lid, or equivalent.
  - 2. Gate Valve box in planting areas: Christy F08 round concrete valve box (8" ID) with F08R concrete lid, or equivalent. Use F14 ADS adapter and extension for sizes 2.5 inches and larger.
  - 3. Ball Valve box: Same as 2.04, A.
- D. Control Valve box marking: Plastic lids shall have a branded markings, and concrete lids shall have a painted text on the top of lid with minimum 2" high letters showing controller letter and station number.

## 2.5 CONTROLLER

- A. The irrigation controller is existing and shall remain in place. Verify open stations and spare wire, if any, in the area of work.
- B. Grounding materials shall conform to ASIC Guideline 100-2002 and manufacturer's specifications.

## 2.7 CONTROL AND TRACER WIRE, COMMUNICATION CABLE

- A. Below-grade conduit for control wires and/or cables shall be PVC for electrical use with long radius sweeps at direction changes and at valve/splice/pull box terminations.
- B. All two-wire control cable splices shall be made with direct bury rated, waterproof wire connectors with silicone sealant, 3M DBY-6 or approved equal. Use one splice per connector sealing pack.
- C. Control two-wire cable shall be jacketed two wire system type, minimum 14 gauge twisted pair, IDWIRE1 or equal per controller manufacturer's specifications. Use different colored jackets for each wire branch. Wire branch splices shall be made with a Paige DCFD splitter.
- D. Decoders shall be two-wire type manufactured by the controller manufacture. Use multiple station decoders at control valve banks wherever possible.

- E. Use grounding products and materials at designated decoders and locations per the manufacture's specifications and ASIC Guideline 100-2002.

## 2.8 IRRIGATION HEADS

- A. Spray/Bubbler Pop-up Head: Molded plastic body with pop-up plastic riser and nozzle. Refer to schedule on drawings. Manufacturer's model numbers are listed with description.
- B. Rotor Pop-up Head: Molded plastic body with plastic riser and nozzle, stainless steel clad riser if specifically noted or standard. Gear driven rotation with memory arc, balanced nozzle sets. Manufacturer's model numbers are listed with description.

## 2.9 DRIP IRRIGATION EQUIPMENT

- A. Flexible distribution tubing shall be 0.66" - 0.70" OD (17mm nominal) fabricated from virgin polyethylene resin specifically designed for subsurface drip irrigation use and conforming to ASTM D 1248 for Type I, Class C, Category 4 Grade P14, and to ASTM D-3350 for PE 122111C. Provide all fittings, connectors and accessories compliant with the tubing for a complete, properly functioning system.
- B. Pressure rating of tubing shall be as defined in Standard ASAE S435. Burst strength shall be minimum 50 psi at 176 degrees F for 4,200 hours.
- C. In-line wye filters shall be type as noted on the Drawings. Filter element shall be molded polyester screen cylinder with minimum 150 mesh screen (blue).
- D. Preset pressure regulators shall be type as noted on the Drawings for above or below ground application.
- E. In-line emitter tubing shall be a below grade product with self-cleaning emitters. Manufacturer as noted on the Drawings.
- F. Flush valve as noted on drawings.
- G. Operation indicator shall be a 6 inch pop-up sprinkler body with built-in check valve. Install a bubbler or variable arc nozzle that can be adjusted to a no-flow condition, Hunter ECO-INDICATOR, or equal.

## 2.10 CONCRETE

- A. Cast-in-place Portland cement concrete used for pipe encasement, cover, thrust blocks, pipe support or other below-grade use shall at minimum comply with 2,800 psi 28 day strength.

## 2.11 OTHER MATERIALS

- A. Materials not specifically indicated but necessary for the proper execution of this work shall be of first quality as selected by the Contractor subject to the acceptance of the Owner.
- B. All materials appearing in the legend and details of the irrigation drawings are to be furnished and installed by the Contractor unless specifically noted to the contrary. Contractor is responsible for

installation according to plans and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

- C. Granular bedding material shall be clean natural occurring sand, free from clay, salt, sea shells or organic material, suitable for the purpose intended, and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve.

## PART 3 - EXECUTION

### 3.1 SYSTEM DESIGN AND VERIFICATION

- A. Contractor shall verify existing pressure and any existing irrigation equipment, and shall inform the Owner of any discrepancies between the existing systems' make and model of equipment, such as sprinkler heads, control valves, etc., and those indicated in the Drawings in writing prior to the start of irrigation system installation. Failure to inform the Owner of any discrepancy within seven working days prior to beginning of system installation will place the responsibility of any and all corrective action on the Contractor at no expense to the Owner.

### 3.2 PIPING INSTALLATION

- A. General:

- 1. Any equipment installed by the Contractor and deemed to be for the use of the Owner in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Equipment deemed by the Owner to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Any changes made by the Contractor shall be done without any additional cost to the Owner.
- 2. The Contractor shall be responsible for layout of proposed facilities and any minor adjustments required due to differences between existing conditions and the Drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. The Owner will indicate the proposed precise location of the control panels. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Where head spacing is not specifically noted, Contractor shall install sprinkler heads evenly along the irrigation area's perimeter. Flush all lines prior to installation of heads.
- 3. Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance to manufacturer's recommendations to allow for expansion. Lay on solid bedding, at uniform depth.

- B. The Contractor shall examine all other portions of working drawings and plan trenching and pipe layout so that no conflict will arise between irrigation and any other work. Any corrective action will be the Contractors responsibility at no further expense to the Owner.

- C. Excavations:

- 1. Excavations shall be open vertical construction, sufficiently wide to provide clear working space around the work installed and to provide ample space for backfilling and tamping.

2. The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the Owner. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Owner and Owner. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Owner, plowing shall be terminated.
3. Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.
4. Unless written approval for using native soils as bedding material is given by the Owner, main line pipe shall be placed on a minimum 6 inch depth of granular bedding material.
5. Excess trench soil with rocks greater than ½ inch diameter shall be removed from the planted area and spread as directed by the Owner.
6. When two pipes are to be placed in the same trench, it is required to maintain a minimum four inch (4") horizontal separation between pipes.
7. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
  - a. 24-inch minimum over main lines.
  - b. 18-inch minimum over non-pressure (rotary pop-up) lateral lines.
  - c. 12-inch minimum over non-pressure (pop-up spray head) lateral lines.
  - d. 24-inch minimum over any lines located out in road surface area of paved streets.
  - e. Maximum cover above the top of the pipe shall not exceed twelve inches (12") greater than the required minimum cover.
  - f. 12-inch minimum cover over drip line non-pressure lateral lines.
  - g. 4-inch minimum cover over in-line emitter or main distribution tubing.

D. Assemblies:

1. Routing of pressure supply lines as indicated on drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details on plans.
2. Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice.
3. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
4. All threaded pipe and fittings shall be assembled using an approved teflon tape, or equivalent, applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
5. No main line elbows, branch tees or isolation valves are to be located closer than five (5) feet to each other without prior approval of the Owner.

E. Line Clearance: All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Plastic to Steel Connections:

1. At all plastic (PVC) pipe connections, the Contractor shall work the steel connections first. Connections shall always be plastic into steel, never steel into plastic. An approved teflon tape shall be used on all threaded (PVC) to steel, never steel into plastic. An



approved teflon tape shall be used on all thread (PVC) to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved 3/4" wide teflon tape will be required.

2. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

G. Plastic Pipe:

1. The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point.
  - a. All lumber, rubbish, rubble, concrete and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.
  - b. Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. One additional foot per one hundred (100) feet of pipe is the minimum allowance for snaking. Never lay pipe when there is water in the trench or when the temperature is 32 degrees F or below.
  - c. All changes in direction of pipe shall be made with fittings, not by bending. No main line fittings for changes in direction shall be greater than 45 degrees. Provide a minimum five (5) feet between changes in direction elbows.
  - d. Safely handle primers and cements per ASTM F-402. Make solvent weld joints per ASTM D-2855 with a non-synthetic bristle brush in the following sequence:
    - 1) Make sure pipe is cut square and all rough edges and burrs are removed. All connecting surfaces are properly cleaned and dry prior to application of pipe primer.
    - 2) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.
    - 3) Apply an even coat of solvent to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
    - 4) Apply an even light coat of solvent to the inside of the fitting.
    - 5) Apply a second coat of solvent to the pipe.
    - 6) Insert the pipe quickly into the fitting and turn pipe approximately one-eighth to one-quarter turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen seconds so the fittings do not push off the pipe.
    - 7) Using a clean rag, make sure to wipe off all excess solvent to prevent weakening at joint.
    - 8) Exercise care in going to the next joint so that pipe is not twisted, thereby disturbing the last completed joint.
    - 9) Allow at least fifteen minutes setup time for each welded joint before moving.

- 10) Repairing plastic pipe when damaged shall be done by replacing the damaged portion of pipe.
- H. Concrete Thrust Blocks: Concrete anchors or thrust blocks shall be provided on pressure main pipelines 2 inches or greater in diameter at abrupt changes in pipeline grade, changes in horizontal alignment (bends, tees and crosses), reduction in pipe size (reducers, reducing tees or crosses), end-line caps or plugs, and/or in-line isolation valve to absorb any axial thrust of the pipeline. The pipe manufacturer's recommendation for thrust control shall be followed. Thrust blocks must be formed against solid unexcavated earth (undisturbed). Do not enclose entire joint in concrete. Provide a minimum of two cubic feet of concrete for each thrust block.
  - I. Concrete thrust blocks may be eliminated if the main line piping system uses self-restrained fittings and bell joint restraints throughout.
- 3.3 PIPE DEPTH AND BACKFILL
- A. Backfill shall not be placed until the installed system has been inspected, pressure tested and approved by the Owner.
  - B. Backfill for first 6 inches underneath, and 4 inches around and above main line pipe and control wires shall be granular bedding material, unless the Owner approves in writing that native soil may be used for initial backfill in lieu of granular bedding material. Backfill material for the upper portion of the trench shall be approved soil. Unsuitable material, such as pipe remnants and wire including clods and rocks over two inches (2") in size, shall be removed from the premises and disposed of legally at no cost to the Owner.
  - C. Backfilling for all pipe shall be carried out in two basic stages.
    1. Stage One Backfilling: This shall be accomplished as soon as possible after the pipe is laid. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding material should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.
    2. Stage Two Backfilling: This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill material in four inch (4") layers and hand tamp to achieve density similar to adjacent soil. After twelve inches (12") in main line trenches and eight inches (8") in lateral line trenches of hand tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in six inch (6") layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to avoid damage to the pipe from machinery that is too heavy. All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks uncovered and not used as backfill must be collected and removed from the site.
  - D. All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and puddled to eliminate any voids.

- E. Surplus earth remaining after backfilling shall be disposed of as directed by the Owner.
- F. PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of temperature of the pipe may cause separation of joints or fittings.
- G. Contractor shall fill with properly amended topsoil any irrigation trench that subsides during the warranty period. Contractor shall assume all cost associated with the trench repair, including but not limited to plant replacement of a size of plant disturbed at the time of the repair.

### 3.4 BACKFLOW PREVENTION ASSEMBLY

- A. Check the backflow prevention assembly for any leaks or improper operation, and notify the Owner if any negative issues are found.

### 3.5 CONTROL AND TRACER WIRE, AND COMMUNICATION CABLE

- A. Communication/sensor cable shall be installed in electrical conduit with long radius sweeps at direction changes and at valve/splice/pull boxes. Maintain a minimum six inch clearance to adjacent pipe. Minimum cover shall be 24 inches.
- B. Install tracer wire along the top of pipe at the following locations:
  - 1. All pipe sleeves.
  - 2. Main line pipe without adjacent control wire.
- C. All 2-wire splices/connections shall be made with a 3M DBY-6 direct bury splice kit in a valve box.
- D. All 2-wire splices at cable branches shall be made with Paige Decoder Cable Fuse Device (DCFD) or equal. Control wire runs shall be continuous between main line branches. Branch splices shall be located in a valve box.
- E. Install decoder grounding at locations and in a manner as required by the manufacturer's specifications and per ASIC Guideline 100-2002.

### 3.6 VALVES

- A. The Contractor shall make all necessary connections for operation, and shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Where pressure regulating electric control valves are specified, the Contractor shall adjust the valve so a uniform distribution of water is applied by the heads, and that the most remote heads operate at the pressure recommended by the head manufacturer.
- B. Each valve is to be enclosed in a separate valve box. The valve box shall be secured on firm soil clear of valves and wiring connections. Valve boxes and lids shall be set to finished grade or as indicated on the Drawings. Use valve box extensions of the same material as the box to the proper depth below the pipeline. Valve boxes shall be supported by common bricks at each corner and at the long side of the box. Use a minimum of six bricks to support rectangular boxes and four bricks to support round boxes. Backfill carefully and properly compact in order to prevent settlement and subsequent damage.

- C. Install a concrete collar around valve boxes when located in asphaltic concrete pavement or in turfgrass areas.
- D. When existing valve and/or splice boxes are within the area of work, replace in kind any damaged boxes and/or lids, unless noted otherwise. Adjust the elevation of all existing boxes within the area of work to final grade per the drawings.
- E. Locate valve boxes in ground cover/shrub planting areas instead of turfgrass areas whenever possible. Locate valve boxes 18" from and perpendicular to adjacent paving. When grouped together, provide equal spacing of at least 36" between boxes.
- F. Permanently attach the plastic valve identification tag to the remote control valve body and locate so it's clearly visible in an open valve box.
- G. Permanently secure the control valve identification label to the top of the valve box lid with non-corrosive connectors.

### 3.7 AUTOMATIC CONTROLS

- A. Install the controller and/or associated equipment, enclosure, sensors, and accessories per the manufacturer's details and installation requirements, and the construction documents.
- B. Connect operational control wires or accessory components to the controller, and program valve schedules appropriately for the new planting.
- C. The Owner shall review the fully functional operation of the irrigation control system prior to acceptance of the system, and as a requirement for the start of maintenance.
- D. Install automatic controller chart in laminated or watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller in the work area.

### 3.8 SPRINKLER HEAD INSTALLATION

- A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Flush all lines prior to installation of heads.
- B. Overhead distribution sprinkler heads shall be installed as detailed, set adjacent to the edge of hardscape elements (6 inches for spray heads, 12 inches for rotary heads) and perpendicular to the finish grade. Sprinkler heads shall be a minimum 2 feet, and preferably 3 feet (if planting layout permits) from building walls.
- C. Where individual shrub bubblers are installed, each plant shall have a bubbler within 12 inches or less of the shrub rootball.
- D. Upon completion of the installation, the Contractor shall adjust or change sprinkler head nozzles to uniformly distribute water without overspray and shall place entire irrigation system in first-class operating condition without any additional cost to the Owner.

- E. Sprinkler heads shall be adjusted in order by fully opening the sprinkler furthest from the control valve and working back toward the control valve. Adjust sprinkler heads which spray toward buildings or adjacent hardscape so that water spray does not contact the side of buildings or significantly over-spray onto hardscape .

### 3.02 ELECTRICAL SERVICE

- A. Electrical service shall be provided to the controller and booster pump location by the electrical subcontractor. The irrigation subcontractor shall make the electrical power connection to the controller and booster pump per code requirements.
- B. Install grounding rods, plates, etc. per manufacturer's and CEC code requirements

### 3.10 SPRINKLER HEAD INSTALLATION

- A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Flush all lines prior to installation of heads.
- B. Overhead distribution sprinkler heads shall be installed as detailed, set adjacent to the edge of hardscape elements (2 - 4 inches for spray heads, 6 - 8 inches for rotary heads) and perpendicular to the finish grade. Sprinkler spray heads directed toward a building shall be a minimum 7 feet from building walls, and a minimum 2 feet when directed away from the building. Sprinkler heads in turfgrass areas shall have a minimum 10 foot radius except for corners.
- C. The top of the nozzle in pop-up bodies shall be flush to the finish grade in areas to receive turfgrass seed/stolons, and in ballfield skinned infields. The top of the nozzle shall be one-half inch (1/2") above the finish subgrade in areas to receive standard cut turfgrass sod.
- D. High speed or other sprinkler heads in dust control zones at ballfield skinned infields shall be installed in turfgrass areas where directly adjacent to the skinned infield.
- E. Where individual shrub bubblers are installed, each plant shall have a bubbler within 10 - 14 inches of the shrub center.
- F. Upon completion of the installation, the Contractor shall adjust or change sprinkler head nozzles to uniformly distribute water without overspray and shall place entire irrigation system in first-class operating condition without any additional cost to the Owner.
- G. Sprinkler heads shall be adjusted in order by fully opening the sprinkler furthest from the control valve and working back toward the control valve. Adjust sprinkler heads which spray toward buildings or adjacent hardscape so that water spray does not contact the side of buildings or significantly over-spray onto hardscape

### 3.11 DRIP IRRIGATION SYSTEM

- A. Install control valves, wye strainer, pressure regulator and rigid PVC lateral distribution lines or manifolds prior to planting soil conditioning operations.

B. Install in-line emitter tubing as follows:

1. After planting soil has been amended, tilled and rough graded, remove and stockpile the planting soil to the required depth of the in-line tubing, and install and stake drip tubing taking into account adjustments needed in the tubing location based on the planting layout. Stake in-line tubing at every-other emitter. Install flush and air relief valves, and operation indicator. Install the operation indicator on the supply manifold with a swing joint in a location easily visible by maintenance personnel.
2. After system flushing, verification of proper operation and inspection, reinstall the stockpiled planting soil and finish grade to final elevation.

C. Operate the system to moisten the planting soils prior to planting operations.

D. Program the controller to operate the drip system using the controller's "cycle and soak" feature in order to apply the required daily watering amount in three equal cycles with a one hour delay between cycles..

3.13 CONCRETE

- A. Concrete shall be installed in accordance with the relevant portions of the Site Concrete specification section.

3.14 COMPLETION AND MAINTENANCE

- A. After the system has been completed but prior to the start of maintenance, the Contractor shall operate the automated system with the Owner, shall instruct the Owner in the operations and maintenance of the system and controls, and shall program the controller for each station. If site central control system equipment is installed, the authorized central control distributor/installer shall program the central base station to communicate with the site control system, and shall verify that proper communication protocols are operational.
- B. The irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the maintenance period or until Final Acceptance of the project, whichever is greater. Irrigation system maintenance shall commence upon an acceptable review following the completion of irrigation installation, planting operations and general clean-up.
- C. The maintenance period shall not terminate until the close-out documents and as-builts record drawings have been submitted and accepted.

3.15 REPAIR AND CLEAN-UP

- A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to new planting and improvements. Disturbed and/or damaged areas shall be restored to their original condition to the satisfaction of the Owner.
- B. Where trenching or other work disturbs newly planted turfgrass or planting, the Contractor shall reinstall the existing sod if viable, or install a full width of new turfgrass sod or planting to match the existing turfgrass/planting species/variety and size, after first conditioning the top 6 inches of soil per the Landscape Planting specification. Adjust finish grades to account for the new turfgrass sod's soil mat so that the new sod is flush to the adjacent turfgrass.

- C. After the irrigation operations are completed, the Contractor shall remove all trash, excess materials, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired or material replaced at the Contractor's expense. The site shall be left in a neat and orderly condition to the satisfaction of the Owner.

END OF SECTION

## SECTION 32 90 00- LANDSCAPE PLANTING

## PART 1 - GENERAL

## 1.1 SCOPE OF WORK

- A. The Contractor shall furnish all material, labor and equipment necessary to install all landscape work as indicated in the plans and specifications.
- B. The landscape work includes but is not necessarily limited to the following:
  - 1. Soil preparation including cross ripping of all planting soil.
  - 2. Weed control including an application of a pre-emergent herbicide.
  - 3. Providing import planting topsoil at raised grade planters and/or at planting areas needing fill.
  - 4. Mechanically rock picking turfgrass areas receiving seed or stolons.
  - 5. Fine grading, conditioning and amending planting topsoil.
  - 6. Installation of turfgrass sod and/or seed.
  - 7. Planting new trees, plants and ground covers.
  - 8. Tree drainage sump boring and testing.
  - 9. Root Barriers.
  - 10. Installation of mulch.
  - 11. Ninety (90) day maintenance.
- C. Related Work Specified Elsewhere
  - 1. Contract Drawings, Addenda, general provisions of the Contract, including General and Supplemental Conditions, and Division 1 Sections apply to work of this section.
  - 2. Section 31 20 00 - Earthwork
  - 3. Section 31 22 22 - Soil Materials
  - 4. Section 32 01 90 – Existing Landscape Protection
  - 5. Section 32 84 00 - Irrigation System

## 1.2 DEFINITIONS

- A. Unless noted otherwise, the term "approved" shall mean by the Owner in writing.
- B. Agencies and Organizations:
  - 1. ASTM- American Society for Testing and Materials
  - 2. ANSI – American National Standards Institute
  - 3. ISA – International Society of Arborists
  - 4. SSPWC – Standard Specifications for Public Works Construction, by the American Public Works Assoc./Associated General Contractors of California.
  - 5. TPI – Turfgrass Producers International
- C. Owner: The Owner's authorized representative or authorized consultant.

## 1.3 QUALITY ASSURANCE

- A. The work of this Section shall be performed by a single firm experienced in landscape planting and holding a current California Contractor's A or C27 License.
- B. Tree and plant quality and sizes shall conform to the current edition of "American Standard for Nursery Stock" for Number One nursery stock as adopted by the American Nursery & Landscape



Association (ANSI Z60.1). Plants shall be of uniform, standard size for their listed container size, neither overgrown and root bound or encircling, nor so recently transplanted that the root system is not thoroughly well established throughout the container. Roots should reach the sides of the container and maintain a firm root ball. Pruning shall not be done prior to delivery except by prior approval.

- C. Trees shall also comply with quality characteristics described in "Guideline Specifications for Nursery Tree Quality" current edition, published by the Urban Tree Foundation. Trees not in compliance with any of the following characteristics may be subject to removal and replacement, whether planted or still in their containers.
  - 1. Acceptable caliper and height ranges for the Type, Form and Size of tree.
  - 2. An intact central leader, or after heading of an old leader, the new leader diameter is greater than one-half the diameter of the old leader. Co-dominant leaders are not acceptable.
  - 3. Scaffold branch diameters are less than two-thirds the diameter of the trunk, and without included bark at the attachment.
  - 4. Scaffold branches shall be balanced, well spaced vertically, and with a radially blank section no greater than one-third of the canopy circumference.
  - 5. Temporary branches on the lower trunk shall be less than three-eighths inch diameter, and the clear trunk height shall be no more than forty (40) percent of the overall tree height.
  - 6. The root collar and rootball shall be free of defects, including circling, kinked and girdling roots. Roots at the edge and bottom of the container shall be less than one-quarter inch diameter, and uniformly distributed throughout the container.
  - 7. The tree canopy width shall be a minimum of twenty-five percent of the standard form tree height, except for naturally columnar forms.
- D. Botanical names shall take precedence over common names. Provide plants that are true to name. Tag one representative plant of each species and size with the botanical name and size.
- E. Inspection:
  - 1. All landscape work and materials shall comply with applicable Federal, State, County and City regulations.
  - 2. All plant material shall be reviewed onsite by the Owner's Representative and/or Landscape Architect prior to positioning and planting. Review shall not limit the right of rejection during any stage of the work until Final Acceptance for any reason including condition of the foliage or root ball, size, variety, form, appearance, latent defects or injuries. Rejected plants shall be removed from the site and replaced immediately by the Contractor at no additional cost to the Owner.
- F. Qualifications of Workers
  - 1. Employ skilled workers who are thoroughly trained experienced in landscape planting and who are completely familiar with specified requirements and methods needed for proper performance of the work in this section.
  - 2. Provide adequate supervision by a qualified foreman fluent in English that will be continuously onsite during the performance of this work.
  - 3. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation. Submit a copy of the Certificate.
- G. Any pruning of existing trees specified as part of this Work shall be performed under the direct supervision of an ISA Certified Arborist and in compliance with ANSI A300-Part 1 Standard

Practices (Pruning).

#### 1.4 SUBMITTALS

- A. In accordance with the Submittal section, submit:
1. A complete materials list of all items proposed to be furnished including estimated quantities.
  2. Laboratory analyses of soil conditioning materials shall have been performed within one year of the submittal date.
  3. Quality Certificates and/or Certificates of Inspection required by government agencies (providing duplicate copies for the Owner's Representative).
  4. Qualified Applicator Certificate, and DPR Registration Certificates and Material Safety Data Sheets for all pesticides/herbicides proposed for use.
  5. Submit photos with a scale marker of all boxed trees proposed for use from the nursery source. Photos shall clearly show the individual tree form without background greenery.
- B. Soil amendments: Submit one (1) pint sample and an analysis of organic compost and mulch.
- C. Other Samples: When requested by the Landscape Architect and/or Owner's Representative.
- D. Soil Fertility Analysis and Recommendations:
1. The Contractor shall provide and pay for a fertility analysis of the existing topsoil and any proposed import planting topsoil. After mass grading operations are completed, native soil samples shall be collected for the fertility analysis by collecting a minimum of 5 representative samples of the soil per acre throughout the area of work. Separate samples shall be produced for cut and fill areas, and for any other area composed of soils not similar to the existing soils. Each sample shall be a minimum of one pint each, and shall be thoroughly mixed together to prepare a homogenous sample. A one quart representative sample for cut, fill and any other special conditions shall be submitted to the soil testing laboratory as a representative sample for fertility analysis. The fertility analysis shall at a minimum provide the following data:
    - a. soil texture class and percent sands, silts and clays per ASTM D422
    - b. estimated soil infiltration and percolation rates
    - c. pH
    - d. organic matter (%)
    - e. total soluble salts (ECe)
    - f. Cation Exchange Capacity (CEC) and Percent Cation Saturation for K, Mg, Ca and Na
    - g. major and minor nutrients (ppm).
  2. Recommendations for improvement of the soil conditions for optimum plant growth shall be made by the testing laboratory, and at a minimum shall include the following:
    - a. A fertilizer and amendment application program (including macro and micro nutrients) for both pre-planting and maintenance fertility applications for broad area tillage and for planting pit backfill (pre-plant only).
    - b. Treatments to neutralize soil pH and to correct any adverse conditions as warranted.
    - c. Recommendations shall address soil conditioning for both planting area tillage and tree/plant planting pit backfill.

3. The soil analysis and recommendations shall be performed by one of the following laboratories capable of providing the above analyses by a licensed soil scientist:
    - a. D&D Agricultural Laboratory. Contact Darrin Peters at 559-348-1818.
    - b. Wilber-Ellis Company. Contact Michael Cline at 209-442-1220.
    - c. Wallace Laboratory. Contact Garn Wallace at
  4. The Contractor shall submit the results of the soil testing investigations and shall receive written direction from the Landscape Architect before proceeding with any soil conditioning activities such as fertilizing and/or adding amendments.
- E. Within seven days from the start of the maintenance period, submit a calendar of maintenance activities, including scheduled dates for mowing, fertilizing, weed control and all other activities. Provide the quantities of maintenance fertilizer and any other materials scheduled to be used in each application during the maintenance period.
- F. Submit invoices and/or delivery tags from material suppliers for all amendments, fertilizer, seed, plants, mulch and any other materials provided for the landscape planting installation and applied during the maintenance period. Submit tags from seed packaging indicating seed varieties, percent purity and percent germination minimums. The invoices and/or delivery tags shall be provided directly to the Owner's Representative/Inspector of Record within 24 hours of delivery to the site, as well as to the normal submittal recipients per the Contract Documents.
- G. Close Out Documents: Submit prior to the start of the maintenance period, two bound hard and digital copies of the following:
1. Cover sheet stating Contractor's address and telephone number, duration of guarantee period, and a list of plant nurseries, materials and equipment vendors with names and addresses of the vendor/manufacturer representatives and warranty periods.
  2. A "CERTIFICATE OF CONSTRUCTION COMPLIANCE" which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions.
  3. Maintenance Manuals and Instructions: Submit a monthly schedule of procedures to be established by Owner for maintenance of landscapes (trees, mixed planting and turfgrass) for one full year and shall include recommendations for fertilizing, pest and disease control, mowing, aeration and top dressing.
  4. Soil Amendment and Seed/Stolon Confirmation Form noting the installed quantities of materials and the person who confirmed the delivery and installation of the materials.
  5. Operations and Maintenance Manuals and Warranty certificates for any maintenance equipment turned over to the Owner.
  6. As-built Record Drawings with all modifications to the Drawings noted in red ink, and the Landscape Planting Observation Log completed.

#### 1.5 AVAILABILITY

- A. The Contractor shall confirm availability of plants, supplies, and materials prior to submitting his landscape bid. Plant variety substitutions are not desired.
- B. If a plant is found not to be suitable or available, the Contractor is to notify Landscape Architect before bidding. The Landscape Architect is then required to select a reasonable alternate and to inform all those bidding of the availability of the original plant. If a substitute is selected it must

be of the same size, value and quality as the original plant. Failure to inform the Landscape Architect of unavailable plants prior to bidding will require that all plants specified shall be provided by the Contractor at time of installation.

- C. Plant container size listed on construction documents are minimum acceptable size. If plant material specified is not substituted prior to award of the contract the minimum container size specified shall be provided by the Contractor. If the Contractor can not provide the minimum specified size plant material at the time of installation, the Contractor shall be required to install a larger size container of the plant specified at no additional cost to the Owner.

#### 1.6 EXISTING CONDITIONS

- A. The Contractor is to visit the job site to verify existing conditions including soils, vegetative growth, subsurface conditions, existing grade and drainage, irrigation system etc. making allowances in his bid for any required work to provide the landscape installation as specified in the construction documents.
- B. The Contractor shall notify the Owner to locate underground lines prior to hole boring or trenching. Do not permit heavy equipment such as trucks, rollers, or tractors to damage utilities. Hand excavate as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned. Prevent damage to temporary risers of underground irrigation system and similar obstructing work located in the landscape areas.
- C. If there is a conflict with existing utilities, improvements and/or planting and the proposed planting, Contractor shall promptly notify the Owner's Representative for instructions as to further action. Failure to do so will make Contractor liable for any and all damage or corrective actions arising from his operations.
- D. Prior to the start of this work, the Contractor and the Owner's Representative shall verify the operational condition of that portion of the existing irrigation system pertaining to the proposed planting area. The Contractor shall notify the Owner's Representative of any repairs and/or corrections necessary for proper functioning and coverage. The repairs and/or corrections shall be completed before any plant material is planted. Failure to perform system verification and provide notification prior to the start of this work will make the Contractor liable for any and all repairs and/or corrections necessary for proper functioning and coverage, as well as any required plant replacement, without any additional cost to the Owner.
- E. No plants shall be planted in situations that show poor drainage infiltration or low areas that result in standing water. Such situations shall be corrected by the Contractor as directed by the Landscape Architect or Civil Engineer. Failure by the Contractor to notify the Owner of poor drainage conditions prior to proceeding with the conditioning or planting operations shall place the responsibility for any plant removals, additional soil conditioning and replanting on the Contractor without any additional cost to the Owner. Any corrections of finish grading not in compliance with the Contract Documents including plant removal, soil conditioning and replanting shall be performed by the Contractor at no additional cost to the Owner.

#### 1.7 PROTECTION

- A. The Contractor shall guarantee repair of damage to any part of the premises resulting from but not limited to leaks, defects in materials or workmanship, operation of equipment, storage of materials and/or equipment, installation of underground or overhead utilities. The Contractor

shall be liable for any and all accidents resulting from his work, including open holes and trenches during construction.

- B. Protect new and existing landscape areas in the area of work from theft, loss, damage and deterioration during storage, installation and maintenance. Protect from unauthorized persons (trespassers) as well as from operations by other contractors and tradesmen, and landscape operations. Protect all planted turf and shrub areas from persons as well as operations of other contractors and the Owner. Cost of protection shall be born by the Contractor with means of protection such as temporary fencing as approved by Owner. Cost for protection shall be included in the Contractor's bid for the work.
- C. Contractor shall repair or replace damaged work and/or damage to existing improvements/landscape as identified by the Owner's Representative to a condition acceptable to the Owner's Representative. No additional payment will be made to the Contractor for repair or replacement of damaged work and/or damage to existing improvements/landscape.

#### 1.8 OBSERVATIONS

- A. General:
  - 1. Installation and operations must be approved by the Owner.
  - 2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Owner. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.
  - 3. In all cases, where inspection of the planting work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner's Representative, the Contractor shall notify the Owner's Representative at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.
- B. The Owner's Representative, Project Inspector or Landscape Architect shall perform periodic observations and shall record the observation on the Landscape Planting Observation Log form on the As Built Record Drawings. Such observations shall include but are not necessarily be limited to:
  - 1. Weed control operations prior to other portions of work.
  - 2. Ripping and soil conditioning of the planting area.
  - 3. Layout of the plant material and trees at the site prior to planting in order to avoid conflicts and to meet the design intent.
  - 4. Condition and quality of plant material prior to planting.
  - 5. Auguring, digging and preparation of plant pits and drainage sumps for trees and shrubs.
  - 6. Planting and staking of trees.
  - 7. Planting of shrubs, ground cover and turfgrass.
- C. Any corrective action called for shall be immediately performed by the Contractor.
- D. Failure by the Contractor to obtain the above observations shall place the responsibility on the Contractor for any relocation and/or replacement of planted trees or shrubs.

#### 1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Plant label shall identify each species and variety. A label shall be attached to each individual plant or block of identical plants grouped together.
- B. Adequately protect plants from sun and wind prior to planting. Do not allow stored plant material to dry out at any time.
- C. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site. Store materials and equipment in a location as directed by the Owner's Representative.

#### 1.10 PESTICIDE NOTIFICATION

- A. A written notification of any and all pesticide/herbicide products scheduled for use by the Contractor or their representative on the Owner's property must be submitted to the Owner's Representative at least seven days prior to the scheduled application. Notification shall include the product name, manufacturer's name, the pesticide active ingredient, the U.S. EPA and CalDPR registration numbers, the scheduled date and application areas, and the reason (target species) for the application.

#### 1.11 REPAIR OF DAMAGED EXISTING PLANTING AREAS

- A. The Contractor shall be responsible to repair all damage and/or distress to existing planting areas including turfgrass, shrubs, ground covers, perennials, etc., whether specifically shown on the Contract Documents or not, as a result of construction operations, material and/or equipment storage, site access, site offices, utility and/or irrigation line installations or other actions.
- B. Replacement shrubs shall be 15 gallon size, replacement ground cover and perennial plants shall be 5 gallon size, and turfgrass shall be full width sod. Damaged areas shall be amended, and finish graded per the Contract Documents prior to planting. Non-turfgrass planting areas shall also receive wood mulch as specified herein. The limits of repair shall be determined by the Owner.

#### 1.12 SEASONAL REQUIREMENTS FOR TURFGRASS SEED / STOLON PLANTING

- A. Warm-season turfgrass seed /stolon planting shall be performed between May 1 and August 1. Any turfgrass seed application outside of the above period shall be an approved cool-season turfgrass variety, blend or mix and shall be temporary until the permanent warm-season turfgrass can be planted.
- B. Contractor may at his own risk plant warm-season turfgrass seed/stolons after August 1. However, if the warm-season turfgrass does not adequately germinate and develop into a full stand of grass within forty-five (45) days to the satisfaction of the Owner and Landscape Architect, the Contractor shall be responsible for overseeding with an approved cool-season turfgrass, and shall also maintain the cool-season turfgrass and reinstall the warm-season turfgrass after May 1 of the following year per Subsection C below at no additional expense to the Owner.
- C. If a warm-season turfgrass is originally specified but a cool-season variety, blend or mix is temporarily installed outside of the above planting period, the Contractor shall perform the following work at no additional expense to the Owner.
  - 1. Maintain the temporary cool-season turfgrass for ninety (90) days per Subsection 3.16.

2. Return to the project site during the warm-season planting period, and provide worker sanitary facilities if not available.
3. Prepare topsoil samples and provide a soil fertility analysis as described in 1.05, E.
4. Perform two cycles of herbicide removal of the cool-season turfgrass, and remove the resulting organic debris.
5. Aerate the topsoil with slicing tines to a minimum depth of six (6) inches. Make a minimum of two passes, each in a perpendicular direction.
6. Apply fertilizer and conditioners to the topsoil as recommended by the soil analysis and approved by the Landscape Architect.
7. Finish grade and prepare topsoil for seed / stolons.
8. Apply the warm-season turfgrass seed / stolons at specified rates per Subsection 3.12.
9. Maintain the newly established warm-season turfgrass for ninety (90) days per Subsection 3.16.

## PART 2 - PRODUCTS

### 2.1 TOPSOIL

- A. Topsoil used in planting areas shall be a clean, friable soil with no noxious weeds, clods or stones larger than 0.5 inch in diameter, subsoil, hardpan, wood, debris, fine organic material greater than 5%, undesirable insects, plant disease or any other natural or extraneous objects detrimental to normal plant growth to a minimum depth of 18 inches from finish grade.
- B. The Contractor shall provide a particle size analysis, fertility testing and amendment recommendations of proposed native and/or import topsoil, and the Landscape Architect reserves the right to reject topsoil not conforming to the minimum specifications. Stockpiled onsite topsoil may be used if analysis and testing determines compliance with these requirements prior to placement. Failure to meet minimum specifications shall result in the removal of any unauthorized placed topsoil at the Contractors expense.
- C. Particle size distribution for topsoil shall meet the following per ASTM D422:
  1. 100% passing a 12.2 mm (1/2") screen.
  2. Minimum 95% passing a 9.5 mm (3/8") screen.
  3. Minimum 75% passing a 2.36 mm (No. 8) screen.
  4. Maximum 45% passing a No. 200 screen.
  5. Silt content shall be a maximum 35%.
  6. Clay content shall be a maximum 25%.
  7. Silt to Clay ratio shall be less than 2 and greater than 0.5.
- D. Other characteristics shall conform to the following:
  1. Permeability rate shall be not less than one (1.0) inch per hour or not more than 20 inches per hour.
  2. The sodium absorption ratio (SAR) shall not exceed 3.0 and the electrical conductivity (ECe) shall not exceed 10 milliohms per centimeter at 25 degrees centigrade.
  3. Soluble boron shall be no greater than 1.0 part per million (mg/l).
  4. Soil pH range shall be 6.0 – 7.5.
  5. Maximum concentration of soluble chloride shall be 150 parts per million.
  6. Maximum concentration of heavy metals shall not exceed the following when the

pH is between 6 and 7:

a.	Arsenic:	0.5 ppm
b.	Cadmium:	0.5 ppm
c.	Chromium:	5 ppm
d.	Cobalt:	1 ppm
e.	Lead:	15 ppm
f.	Mercury:	0.5 ppm
g.	Nickel:	2.5 ppm
h.	Selenium:	1.5 ppm
i.	Silver:	0.25 ppm
j.	Vanadium:	1.5 ppm

7. Petroleum hydrocarbons shall not exceed 100 mg/kg dry soil.
8. Aromatic volatile organic hydrocarbons shall not exceed 2 mg/kg dry soil.

## 2.2 SOIL AMENDMENTS

- A. Organic Compost: "Harvest Premium" as supplied by Harvest Power (559) 435-1114; "WonderGrow Compost" by Grover, Inc. (866) 764-5765, or "Allgro Compost" by Synagro (559) 341-5158, and conforming to the following minimums:
  1. Certified as "Mature" or better per the California Compost Quality Council Maturity Index.
  2. Pass EPA Class A standards for pathogens and heavy metals.
  3. Particle size: 1/8" maximum.
  4. pH: 6.0-7.5.
  5. Macro-nutrients: Minimum of 1.0% Nitrogen, 0.5% Phosphorus, 0.5% Potassium.
  6. AgIndex ratio greater than 2.
  7. Organic matter content greater than 25% dry weight.
  8. Carbon/Nitrogen ratio: less than or equal to 25.
  9. Salinity (ECe): less than 10.0 dS/m.
  10. Odor shall be soil-like (musty or moldy) without any sour, ammonia-like or putrid smell.
- B. Gypsum shall be mined agricultural grade gypsum composed of no less than 100%  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  hydrated calcium sulfate in a pelletized form. Elemental Sulfur shall be a minimum 95% pure agricultural grade.
- C. Dry Humate organic soil conditioner comprised of 70% humic acid from Leonardite.
- D. Endo 120 Mycorrhizae containing a minimum 60,000 living propagules per pound.
- E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

## 2.3 FERTILIZER

- A. Trees and Shrubs: Fertilizer for all trees and shrubs to be BEST PAKS (20-10-5) controlled release fertilizer in a biodegradable 10 gram packet. The BEST PAKS shall be applied at the following rates:
  1. 1 Gallon Can: 1 Best-Pak
  2. 2 Gallon Can: 2 Best-Paks



3. 5 Gallon Can: 5 Best-Paks
4. 15 Gallon Can: 10 Best-Paks
5. 24" Box: 16 Best-Paks
6. 36" Box: 24 Best-Paks

- B. The pre-plant fertilizer shall be a commercial homogeneous, granular pellet:
  1. Pre-plant fertilizer for turfgrass shall be:
    - a. BEST 6-24-24-5S XB+ with Avail
  2. Pre-plant fertilizer for mixed plantings shall be:
    - a. BEST Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.
- C. The maintenance fertilizer shall be a commercial homogeneous, granular pellet:
  1. Maintenance fertilizer for turfgrass shall be one or more of the following:
    - a. Urea 46-0-0
    - b. BEST Ammonia Sulfate 21-0-0-24S, standard grade, or equal
    - c. BEST Nitra King 21-2-4-14S-2Fe, or equal.
    - d. BEST Nitex 20-2-3-12S-5Fe, or equal.
    - e. BEST Polyon 43 (43-0-0) slow release N, or equal.
    - f. Wil-Gro Pro Choice Plus, 31-3-7-6S-3Fe with 9.3% slow release N, or equal.
    - g. Best Landscape Color 14-14-14 (14-6-11.6-3S and micronutrients) with 9.9% slow release N, or equal.
  2. Maintenance fertilizer for mixed plantings shall be the pre-planting fertilizer. Use slow release above for one time fertilization.
- D. Fertilizer material types and analysis may be subject to change based on the findings and recommendations from the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

## 2.4 MULCH

- A. Mulch for on-grade or raised native soil planters shall be a walk-on type of chipped and aged greenwaste woody material without leaves, green wood, sticks, dirt, stones, dust and other non-organic debris as accepted by the Landscape Architect. Particle size 1/2" to 3" in general size.

## 2.5 STAKING & GUYING MATERIALS

- A. Stakes: 2" Diameter lodgepole pine, pressure treated and pointed one end.
- B. Ties: V.I.T. Cinch Tie, 32 inches long, V.I.T. Products, Inc. (619) 673-1760, or equivalent.

## 2.6 PLANTS

- A. Plants shall be typical of their species and variety, shall have normal growth habits, well developed branches and be densely foliated, and shall have fibrous root systems. No substitutions will be allowed unless approved in writing by the Landscape Architect.
- B. Plants shall be free from defects and injuries including disease, insects, insect eggs and larvae and girdled or matted roots.
- C. Quality and size of plants shall be in accordance with ANSI Z60.1-2004, "American Standard for Nursery Stock", and as described in Quality Assurance.

- D. Plants shall not be pruned before planting.
- E. Plant material must be selected from nurseries that have been inspected by State or Federal Agencies.
- F. Plants shall be nursery grown and shall have been transplanted or root pruned at least once in the past three (3) years. Plants shall have been grown under climatic conditions similar to those in the locality of the project.
- G. Each bundle of plants shall be properly identified by weatherproof labels securely attached thereto before delivery to the project site. Label shall identify plant by name.
- H. Nomenclature shall be in accordance with Sunset Western Garden Book, current edition.
- I. No plants shall be removed from their container until a review has been made in the field or at the nursery, or except when specifically authorized in writing by the Owner.
- J. Collected plant material may be used only when approved. Approval shall not limit the right of rejection during work progress for conditions of the root ball, latent defects or injuries.
- K. Where shown a "MULTI" provide trees with a minimum of three trunks.
- L. Plant sizes listed on the planting plan are minimum acceptable sizes. The quantities listed are the Landscape Architect's estimate only. The Contractor is responsible for the quantities of plant symbols shown on the plan, and/or the quantities in hatched planting areas at the specified triangular spacing.

## 2.7 TURFGRASS SOD

- A. Sod shall be produced from certified or approved seed/stolons, fresh and labeled in accordance with U. S. Department of Agriculture Rules and Regulations. Sod quality shall be Premium or Standard Grade per TPI specifications. Harvested sod shall be big roll size.
- B. Sod shall be neatly mowed and be mature enough that when grasped at one end it can be picked up and handled without damage, delivered to the project site, adequately protected and installation commenced within 24 hours of harvesting.
- C. Turfgrass shall be a species and variety as specified in the Contract Drawings. If a warm-season grass is specified and the installation is to be performed between the months of October and April, a species with an established perennial ryegrass overseeding shall be installed. Submit the overseeded product information for approval prior to the installation.

## 2.08 TURFGRASS SEED

- A. Seed shall be delivered in original unopened containers with legible identification labels. Store in a shaded and dry location protected from weather or damage.
- B. Seed shall be from a Certified source, hulled and coated, and shall be a species and variety as specified in the Contract Drawings.
- C. Warm-season Bermudagrass seed shall be a one of the following improved blends:
  - 1. "La Prima" by Seed Research of Oregon. Available from Horizon in Fresno (559)

431-8007.

2. "Bermuda Triangle" by Pennington Seed. Available from Wilber-Ellis (916) 991-4451; or Western Farm Service (559) 686-3375.

- D. Cool-season turfgrass for temporary seeding or overseeding shall be a blend of annual and perennial ryegrass, "SOS 211" by Barenbrug USA or equal. Available from Valley Seed (559) 225-7333.

## 2.9 ROOT BARRIER

- A. A ribbed polyethylene panel of minimum 0.080" thickness equal to Deep Root Partners #UB 24-2 PANEL, (800) 458-7668.

## 2.10 TREE TRUNK PROTECTOR

- A. ArborGard+ polyethylene tree guard by Dimex (800) 334-3776, or equal.

## 2.11 HERBICIDES

- A. Herbicide products for removal of unwanted grass and broad-leaved weeds shall be registered and approved for use by the U.S. EPA and CalDPR, and shall comply with the Owner's Standards and with the "Healthy Schools Act" with current amendments.
- B. Provide pre-emergent and post-emergent, selective herbicide formulations for use on turfgrass areas and/or ornamental shrub/ground cover areas that are not injurious to the proposed plantings and turfgrasses.
- C. Provide a non-selective contact herbicide formulation for use on existing established weeds.

## 2.12 OTHER MATERIALS

- A. Materials not specifically indicated, but necessary for proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

# PART 3 - EXECUTION

## 3.1 EXAMINATION & PREPARATION

- A. General: Verify that existing site conditions are as specified and indicated before beginning this work.
- B. Damaged Earth: Verify that earth rendered unfit to receive planting due to concrete water, mortar, limewater, hydrocarbons or any other contaminant dumped on it has been removed and replaced with clean earth from a source approved by the Owner's Representative.
- C. Examine the area and conditions under which the work in this section is to be performed. Verify that any existing irrigation system within the limit of work is in proper working order with full coverage. Correct conditions detrimental to the timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of the work signifies acceptance of the existing conditions.
- D. Protection:

1. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment within the area of work prior to commencing work.
  2. Mark existing irrigation heads, valves, valve boxes and other below grade equipment or components that are scheduled to remain. Protect in place.
- E. Runoff and Erosion Control: Furnish equipment, materials and labor necessary to control the flow, drainage, and accumulation of excess water running off the work area and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site per the approved SWPPP.
- 3.2 ROUGH GRADING, SOIL PREPARATION, PLANTER BACKFILL
- A. Rough grading shall be performed by other subcontractors to the extent of establishing rough pads, slopes and drainage patterns. The Contractor is responsible for placement of topsoil and grading required to ensure positive drainage in all turfgrass and planting areas. All planting areas shall have a minimum topsoil depth of 18 inches from on-site native and/or approved import sources. Rough grading shall be completed prior to weed control, cross ripping or rock removal operations.
- B. After the completion and acceptance of the weed control operations outlined below, and unless directed otherwise by the Landscape Architect or noted on the Drawings, and except for the area under the canopy of existing trees, the Contractor shall cross rip and till (break up large clumps and clods in excess of 2 inch diameter) the existing soil within all planting areas outside the canopy drip line of existing trees until the soil is loose and friable. Ripping shall be to a minimum depth of twelve inches (12") in turfgrass areas and eighteen inches (18") in shrub/ground cover areas, with ripping tines a maximum 18" apart performed in a minimum of four passes total in different directions (perpendicular and diagonal). The Contractor shall review the completed ripping operation with the Owner's Representative and Landscape Architect to determine compliance. The first 6 inches of any new topsoil fill shall be tilled into the existing soil to a minimum depth of 6 inches prior to placing any further topsoil fill. The Contractor shall provide any additional work as directed by the Owner's Representative after the review to obtain compliance. Do not proceed with the addition of topsoil and/or amendments, or commence rock picking or fine grading until the completed ripping operation is accepted in writing by the Owner's Representative.
- C. Planting area soil under the canopy drip line of existing trees, or in planting beds not accessible by motorized equipment, shall be ripped to a minimum depth of 12 inches using manual spading shovels, forks and/or broadforks and working around major tree roots and/or utilities. In areas receiving new mulch, rip to a minimum depth of 4 inches while protecting any existing plants and their root system. Break up and/or remove rocks and clods as indicated below.
- D. Do not work soil when moisture content is so great that excessive compaction will occur, or when it is so dry that dust will form in air or clods will not break up readily, or when a full ripping depth cannot be achieved. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and dust control. Maintain within 2 percent above or below optimum moisture content for the existing soil type at all times during the work.
- E. After soil ripping and preliminary finish grading is completed, the topsoil shall be cleared of all concrete, wire, sticks, roots, debris and foreign materials. Remove native stones and clods as follows:
1. In shrub/ground cover areas, remove stones and clods greater than one (1.0) inches in diameter from the top 3 inches of finish grade.

2. In general, non-traffic turfgrass areas, remove stones and clods greater than three-quarter (0.75) inch in diameter from the top 3 inches of finish grade.
  3. In designated play or sports field turfgrass areas, remove stones and clods greater than one-half (0.50) inch in diameter from the top 4 inches of finish grade using a mobile tractor pulled, PTO powered, hydraulic controlled rock picker, Cherrington Model 4500 or similar.
- F. Add clean planting topsoil where needed to bring grade to elevation to promote positive drainage. Spread approved planting topsoil over ripped subgrade prior to incorporating amendments.
- G. Backfill all raised grade planters with a minimum depth of 18 inches of imported clean sandy loam planting topsoil conforming to Subsection 2.02 and approved prior to import and/or placement. Failure to obtain import approval prior to backfilling raised grade planters shall result in the removal of any planting and non-approved backfill, and the reinstallation of the work with approved materials.
- 3.3 WEED CONTROL
- A. Weed control pesticides shall only be applied by an individual holding a valid Qualified Applicator Certificate (Category A) issued by the Department of Pesticides Regulation.
- B. The Contractor shall treat any weeds in proposed new turfgrass and planting areas with a post-emergent contact weed killer at manufacturer's approved rates prior to any commencement of work at the site including any irrigation work, ripping of soils or fine grading. Areas planned for turfgrass seed/stolon planting shall in addition receive "grow and kill" weed removal as outlined below.
- C. Weed eradication shall be ongoing throughout the course of the landscape installation. The Contractor shall apply a pre-emergent herbicide after shrub/ground cover planting and prior to mulch installation. Manually remove weed seed heads. At no time will weeds be allowed to become established. Contractor shall provide all weed control operations as directed by the Owner's Representative.
- D. All weed control operations using pesticides/herbicides shall comply with the CalDPR and Owner Standards. The Contractor shall comply with the notification and posting requirements of the "Healthy Schools Act".
1. The Contractor shall notify the Owner per Subsection 1.11, A.
  2. The Contractor shall post highly visible signs around the treatment area in conformance with the "Healthy Schools Act" warning of a scheduled pesticide/herbicide application a minimum of 24 hours before to 72 hours after a pesticide application.
- E. Perform pre-plant clearing and weed control for native open ground areas planned to receive turfgrass as follows:
1. Apply irrigation to encourage weed growth prior to ripping, and to maintain moisture in the soil.
  2. Apply a contact herbicide to weed foliage. Remove weeds and expose bare soil.
  3. Lightly disk/till to a depth of three-inches, followed by a light roller.
  4. Perform a "grow and kill" operation after the first disking/tillage:
    - a. Water and lightly fertilize to encourage weed germination.
    - b. Follow with a second application of a contact herbicide.

- c. Remove weeds and perform a light harrowing or disking.
- 5. Apply irrigation to encourage weed growth. If additional weeds germinate, perform a second “grow and kill” operation.
- 6. Once existing weeds are completely removed, obtain authorization from the Owner’s Representative to proceed with deep ripping, rock removal, soil conditioning and finish grading operations.
- F. Just prior to turfgrass installation, and/or after the shrub/ground cover planting is complete and prior to mulch installation, apply an approved pre-emergent herbicide per the manufacturer’s recommended rates.

### 3.4 SOIL CONDITIONING

- A. Before commencement of any soil conditioning, weed and rock removal shall be completed as outlined above.
- B. Uniformly amend the entire area of topsoil in turfgrass and mixed planting areas per the following bid rates and per the approved modifications as a result of the soils analysis recommendations:
  - 1. Turf and Non-Sloped (less than 4h:1v) Planting Area Soil Conditioning (per 1,000 square feet).
    - a. Compost at a rate of six (6.0) cubic yards (a 2.0 inch thick layer).
    - b. Gypsum at a rate of 100 pounds, or Sulfur at 19 pounds, or an equivalent combination.
    - c. Humate soil conditioner at a rate of thirty (30) pounds.
    - d. A pre-planting fertilizer to turfgrass areas at a rate of 1.25 pounds of actual P and K.
    - e. A pre-planting fertilizer to mixed planting areas at a rate of 1 pound of actual N.
    - f. Endo 120 per Subsection 3.06, Mycorrhizae Application.
- C. Till soil amendments into the entire planting area soil to a minimum depth of six (6) inches. Perform the cultivation in at least two passes, one in each perpendicular directions to the first, so that the amendments are homogeneously incorporated into the topsoil. All cultivation inside the dripline of existing trees shall be performed manually with minimal disturbance to the root system.
- D. Planting backfill for trees and shrubs shall be a mix of four-fifths native soil and one-fifth Compost by volume. Add Humate and Endo 120 Mycorrhizae at 5 pounds each per cubic yard of backfill.
- E. Amendment material types and application rates may be subject to change based on the findings and recommendations of the horticultural soil testing lab, and as such may result in an increase or decrease in the Contract Amount.

### 3.5 FINE GRADING

- A. Upon completion of soil preparation, fine grade all planting and turfgrass areas to a smooth and even slope conforming to and establishing drainage patterns per the approved Grading Plan. Grading shall eliminate all humps and hollows and promote positive drainage in all planting and turfgrass areas.

- B. Where hardscape is installed in existing planting areas, a minimum transition grade width of 2 feet adjacent to the edge of hardscape shall be constructed unless noted otherwise. The maximum slope of any transition grade shall be 20 percent. The area of transition grading shall be planted or repaired as specified herein.
- C. Tolerance of grade differential for planting and general turfgrass areas shall be plus or minus 0.04 foot. If requested, the Contractor shall water test all turf and planting areas after the grading operations are completed in the presence of the Owner's Representative and Landscape Architect. The water test shall consist of applying water to the turf and planting areas to the point where water begins to run over the soil to show the drainage pattern. Make all corrections to the finish grading as required by the Owner's Representative to re-established positive drainage patterns. Acceptance of the finish grading shall be obtained in writing from the Owner's Representative and Landscape Architect prior to proceeding with soil conditioning and planting operations.
- D. Turfgrass sports fields shall be fine graded using a laser controlled machine capable of producing final grades within 0.02 foot plus or minus from the proposed elevations.
- E. After the finish grading process, relative compaction of the soil in turf and planting areas shall range between 82% and 85% relative density. Compaction/moisture levels are generally acceptable if an Oakfield probe is able to penetrate a minimum of six inches into the cultivated planting topsoil with moderate pressure. The Owner reserves the right to require the Contractor to test for over compaction. If the compaction is within the acceptable range, the test will be paid for by the Owner. All testing due to non-compliance will be paid for by the Contractor.
- F. Remove all rocks produced as a result of the soil conditioning and finish grading operations per the requirements of Subsection 3.02.
- G. Finish grades shall be one-half inch (1/2") to three-quarter inch (3/4") for turfgrass sod areas, flush (0.0") for turfgrass seed/stolon areas and two inches (2") for shrub/ground cover planting areas below the finish surface of all adjacent walks, curbs, mowstrips and utility/valve boxes or collars. Transition any grade modification in existing planted areas at a maximum 12h:1v slope to existing grade, unless shown otherwise on the grading plan.

### 3.6 MYCORRHIZAE APPLICATION

- A. In turfgrass planting areas, after fine grading is completed broadcast Endo 120 Mycorrhizae at a rate of one and one half (1.5) pounds per 1,000 square feet (65 lbs. per acre). Lightly rake into the top one inch (1") of topsoil immediately prior to turfgrass installation.
- B. In shrub and/or ground cover planting areas, the Mycorrhizae inoculant shall be incorporated into the soil with the other soil amendments at three (3.0) pounds per 1,000 square feet (130 lbs. per acre) per Subsection 3.04, Soil Conditioning. Inoculant shall also be incorporated into the planting backfill per Subsection 3.04, E.

### 3.7 PLANTING

- A. General Requirements
  - 1. Obtain written approval from the Landscape Architect or Owner's Representative to begin planting operations. The irrigation system shall be fully automated and operational, all weeding, soil conditioning and finish grading completed, and the tree and plant layout approved.

2. Planting shall be performed by workmen familiar with planting procedures and under the supervision of a qualified foreman. The planting foreman shall be on the job site at all times when planting is in progress.
3. Planting operations shall not occur under unfavorable weather conditions.
4. Boxed trees shall be planted first. Shrub planting shall be completed before groundcover is planted.
5. Proceed and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of planting required.
6. Cooperate with other contractors and trades working in and adjacent to the planting work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.

B. Planting Preparation and Operations

1. Planting material shall be provided with adequate protection of root system and balls from drying winds and sun. Do not bend or bind trees or shrubs in such a manner as to damage bark, break or destroy natural shape. Provide protective covering during delivery.
2. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately. If planting is delayed more than six (6) hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage and keep roots moist. Do not remove container grown stock from containers until planting time.
3. All planting areas shall be smooth and even. Finish grades shall be done prior to any placement of plants.
4. Place all trees and shrubs in locations shown on the planting plan and obtain written field approval of the Landscape Architect before planting or digging planting pits. Inform the Landscape Architect seven (7) days prior to placing the plants. Maintain a minimum 15 foot clearance from trees to any light pole, unless specifically noted otherwise.
5. Carefully remove all canned stock from containers with tin snips or approved cutter. Cut away and remove any girdled or matted roots.
6. Excavate holes of circular outline with vertical sides for all plants 15 gallon or less. Boxed trees shall have square planting holes. The vertical sides and bottom of the holes shall be thoroughly scarified to promote union of backfill with existing soils. All trees shall have two drainage sump holes drilled with a twelve inch (12") diameter auger penetrating hardpan layers to a minimum one (1) foot into a sand/gravel layer or to a minimum depth of ten (10) feet below the planting pit bottom. Precautions shall be exercised to avoid smooth sides on the holes. Offset augured holes a minimum of eighteen inches (18") from planned tree location to avoid settling of tree after planting.
7. After cleaning out the sump holes, the Contractor shall test the sumps for drainage by flooding with water. If the water does not drain out within twenty-four (24) hours, auger down as required to achieve such drainage by breaking through the hardpan layer, or by extending the drainage sumps to a minimum depth of 15 feet below the bottom of the planting pit. After obtaining approval of the sump holes, fill the augured drainage sump holes with coarse concrete sand.
8. Tree and shrub planting pits shall be at least two and one half (2.5) times the width of the plant container, but a minimum of 36" wide for trees and 18" wide for container shrubs. Planting pits shall be as deep as the soil depth in the container or box, less the additional height of the crown above the finish grade.
9. Set each plant in the center of the pit, plumb and straight. Set the crown of the plant



at one inch (1") for shrubs, two inches (2") for trees above finish grade. When 1/2 of the backfill mix has been placed, tamp-in, insert fertilizer (BEST PAKS as per Section 2.1B1) and allow no air pockets as remainder of backfill is added.

10. Compact soil around the rootball of all plants and thoroughly water in the entire backfill depth.
11. Excess soil from plant holes shall be cultivated and raked to a smooth outline.
12. Shrubs and groundcovers shall be installed in relation to walks and paving to allow for future growth without obstructing traffic with clearance as shown on the drawings.
13. All plants shall be set in watering basin which shall be as wide as the planting pit, but at least four feet (4') in diameter and four inches (4") deep for trees and two feet (2') in diameter and three inches (3") deep for shrubs and vines.
14. Ground cover plants shall be planted at the spacing noted on the drawings. Not more than fifteen minutes shall elapse from the time any groundcover plant is planted until it is watered.

- C. Pruning: Prune plants in accordance with established horticultural practice. Shearing of any plants will not be acceptable. Tree pruning shall only be performed with the written approval of the Landscape Architect and under the direction of a certified arborist, and shall comply with ISA Pruning Standards (ANSI 300).

### 3.8 MULCH

- A. Prior to any mulch application, perform weed control operations as specified herein.
- B. Where mulch is to be installed in an existing planting area, breakup/till the existing soil in open areas around existing plantings to a minimum 4" depth per section 3.02, and adjust finish grade adjacent to hardscape elements per section 3.05 where not prohibited by existing plantings.
- C. Install a minimum 3" layer of mulch in all non-turf planting areas, except for slopes greater than 3h:1v and seeded areas. Install a minimum 2" layer of mulch in all areas receiving flatted plants.
- D. Install a minimum 3" layer of wood mulch at a minimum 3' radius from the tree trunk of all trees located in turfgrass areas. Provide a smooth finish grade transition to a 2 inch depth where the mulch meets the turfgrass, so that the top elevation of the mulch is flush to the turfgrass soil. Keep mulch off the trunk. For new trees in turfgrass areas, remove the watering berm just prior to the turfgrass planting but maintain the mulched area within the planting pit.

### 3.9 STAKING & GUYING

- A. Trees shall be supported by two (2) tree stakes as shown on the drawings. Cut off the top of stakes damaged by installation or where the stake conflicts with canopy branches.
- B. Stakes shall be set firmly in the ground outside the rootball and where possible set stakes perpendicular to the prevailing northwest wind.
- C. Trees shall be tied to upright stakes loosely with tree ties (see planting detail). Remove the nursery stake.
- D. Multi-trunked trees shall be guyed, or individual branches may be staked and loosely tied as shown on the Drawings.

### 3.10 ROOT BARRIER

- A. Install root barrier along hardscape edges whenever the distance from the center of the trunk to the hardscape edge is less than fifteen (15) feet. Install per the planting details and manufacturers recommendations.

### 3.11 ARBOR GUARD

- A. Install ArborGard+ on all newly planted tree trunks in turfgrass areas per manufacturer's recommendations.

### 3.12 TURFGRASS SOD

- A. The area to be planted shall be finish graded to present a smooth and even surface free of humps and hollows and conforming to the finish grading plans. Where new sod is abutting existing turfgrass, fine grade to allow for the thickness of the new sod soil so that the new and existing sod grades are flush. Immediately prior to planting, the surface of the area to be planted shall be sufficiently loose and friable, with adequate moisture to receive the sod. Avoid laying sod on hot or dry soil.
- B. Lay first strip of sod slabs along a straight line (use a string in irregular areas). Butt joints tightly. Do not overlap edges. On second strip, stagger head joints (similar to a running bond brick pattern). Use a sharp knife to cut sod in order to fit curves, edges, and sprinkler heads.
- C. Install with turf-tired machinery full width sections big roll sod as delivered and flush to adjacent surfaces. Terminating sod edges shall be straight and at right angles to hardscape elements whenever possible.
- D. As the sod is being installed, water the sod lightly to prevent drying out. Continue to lay sod and lightly water until installation is complete.
- E. After laying sod, roll to eliminate irregularities and to form good contact between sod and soil. Avoid a too heavy roller or excessive initial watering which may cause roller marks.
- F. Water the completed lawn surface thoroughly. Topsoil should be constantly moist for a minimum two inches deep. Repeat irrigating at regular intervals to keep sod moist until rooted. The areas shall not be watered to the extent of saturating the soil and causing "flotation" or "flowing" of the top surface of the soil. After water has once been applied, no portion of the planted areas shall be allowed to dry out during the entire maintenance period. After sod roots are established, decrease frequency and increase amount of water per application as necessary to maintain good soil moisture to a minimum 6" depth without standing water or excess runoff. The Contractor shall be responsible to monitor the site and alter the watering times and frequencies to meet site and climatic conditions.
- G. Prior to the start of the maintenance period, fill all seam joint gaps greater than 1/8 inch and less than 0.5 inch with washed concrete sand. Fill any joint gaps of 0.5 inch or greater width with a minimum two foot long replacement sod section in order to achieve a tight joint.
- H. Replace dead or distressed sod with equivalent material as directed by the Landscape Architect.
- I. Do not install turfgrass inside the watering basin of new trees planted in turf areas, or within a 3' radius of existing tree trunks located in turf areas.

### 3.13 TURFGRASS SEED

- A. Complete soil conditioning operations and irrigation system installation prior to seeding. At the time of seeding, the surface of all areas to be seeded shall be free of large stones, sticks, stumps, or other deleterious matter one inch in diameter or larger, and shall be free from all wire, plaster, construction debris of any kind, or similar objects that would be a hindrance to seeding or maintenance.
- B. Maintain adequate soil moisture for seed germination and establishment. Use the cycling (multiple start) feature of the irrigation controller to prevent run-off.
- C. Warm-season turfgrass seed shall be planted at not less than 1/8 inch and no more than 1/4 inch depth at 4.0 pounds per 1,000 sq. feet.
- D. Warm-season turfgrass seed may only be planted when minimum soil temperatures are above 65 degrees F throughout the germination period.
- E. Cool-season turfgrass seed shall be planted at not less than 1/4 inch and no more than 1/2 inch depth at 9.0 pounds per 1,000 sq. feet (3.0 lbs/ 1,000 sq. ft. in each of three directions, the second and third perpendicular and diagonal to the first).
- F. Cool-season turfgrass seed may only be planted when soil temperatures are above 55 degrees F and below 85 degrees F throughout the germination period.
- G. Seed shall be applied by **drill seeding**. For drill seeding, apply one-half of the total quantity of seed required in two different applications in perpendicular directions, e.g. north-south, and east-west.
- H. Protect the seeded area from disturbance (including erosion) and pedestrian traffic with barriers acceptable to the Owner. The Contractor is responsible to repair and reseed any disturbed or damaged areas.
- I. Reseed bare areas failing to adequately germinate a uniform density of plants within 14 days after the scheduled germination. The Landscape Architect shall be the sole judge of adequate uniformity and density. The Contractor shall reseed and/or correct any deficiencies until the acceptance of the seeded area by the Landscape Architect and Owner's Representative.
- J. Do not install turfgrass seed inside the watering basin of new trees planted in turf areas, or within a 3' radius of existing tree trunks located in turf areas.

### 3.14 CLEAN-UP AND REPAIR

- A. All areas shall be maintained in a neat and orderly condition at all times. All reasonable precautions shall be taken to avoid damage to existing planting and structures. Disturbed and/or damaged areas, whether a part of this work or from the work of other trades, shall be restored to their original condition.
- B. Plants and/or turfgrass shown to remain and damaged or removed by construction operations and/or utility/electrical/drainage lines shall be replaced with plants that match as closely as possible to the existing plant species, variety and size. The replacement turfgrass sod variety shall be the same as shown in the Planting Legend if for new work, or shall match the existing

turfgrass variety where the turfgrass is existing. Adjust the finish grade so that the new turfgrass sod abuts flush to the existing turfgrass or to hardscape. The replacement plants and/or turfgrass sod shall be maintained as part of the original scope of work.

- C. After the planting operations are completed, the Contractor shall remove all trash, excess soil, empty containers or any other debris accumulated by the work from the site. All damage caused by the work shall be repaired at the Contractor's expense and the site shall be left in a neat and orderly condition to the satisfaction of the Owner.

### 3.15 PRE-MAINTENANCE REVIEW

- A. A general review will be held prior to the start of the maintenance period upon conclusion of the planting operations, irrigation system installation and after clean-up has occurred. The Owner's Representative shall be informed in writing a minimum of seven (7) working days prior to the time the work is ready for review in order to arrange a suitable time and date for such review.
- B. At the time of review, Contractor shall have all planting areas free of weeds and neatly cultivated and fine graded. All plant basins shall be in good repair. All trees shall be properly staked and tied. All turfgrass areas shall be fully established and have a healthy, uniform and dense stand of grass without weeds or bare spots.
- C. Work requiring corrective action or replacement in the judgment of the Owner's Representative shall be performed within five (5) days after the inspection. Corrective work and materials replacement shall be in accordance with the drawings and specifications and shall be made by the Contractor at no cost to the Owner. A subsequent review shall then be arranged.
- D. If after the review, the Landscape Architect is of the opinion that all the work has been performed as per the Contract Documents, and a uniform stand of healthy dense turfgrass has been established without weeds or bare spots, the Contractor will be given written notice that the maintenance period may begin.

### 3.16 MAINTENANCE - GENERAL

- A. After all work indicated on the drawings or herein specified has been completed, reviewed, and approved, and the turfgrass has been successfully established per the requirements below, the Contractor shall commence a ninety (90) calendar day maintenance period in which the Contractor shall continuously maintain all areas included in the contract during the progress of the work and throughout the maintenance period, or until Final Acceptance of the project, whichever is greater.
- B. Maintenance work includes monitoring the site to control all watering, replanting, fertilizing, mulching, weeding, cultivating and mowing necessary to bring the planted areas to a healthy and vigorous growing condition, and any additional work needed to keep the areas neat, edged, weed and trash free, and attractive.
- C. All trees, shrubs, ground cover shall be kept at optimum growing condition by watering weeding, replanting, fertilizing, cultivating, tree stake repair, spraying for diseases and insects, replace dead or dying materials, pruning as directed, maintaining proper grades of plants, and providing any other reasonable operations of maintenance and protection required for successful completion of the project.
- D. Any date when the Contractor fails to adequately water, replace unsuitable planted areas and

other work determined to be necessary by the Owner, will **NOT** be credited as part of the establishment/maintenance period.

- E. The establishment of turfgrass seed/stolons is herein defined as being all work necessary to germinate the planted turfgrass and grow a full, healthy, uniform stand of smooth and even texture and grade with clean straight edges without weeds or bare spots and has been mowed at least twice per Subsection 3.17. The establishment of turfgrass sod is herein defined as being all work necessary to develop sod without weeds or distressed areas with a minimum rooting depth of 2 inches into site soil.
- F. No additional payment will be made for additional time necessary for turfgrass establishment. The maintenance period shall not start until all contract work has been completed and all close-out documents and materials have been submitted. Turfgrass will be considered weed-free if there is a maximum of one percent undesirable turfgrass species, and nine weeds or less per 50 square yards (one per 50 square feet).
- G. During the progress of the maintenance period, the Contractor and the Owner's Representative shall conduct reviews at no less than 21 day intervals to determine that ongoing maintenance activities have been conducted by the Contractor. If in the opinion of the Owner, ongoing maintenance has not been conducted by the Contractor in a satisfactory manner the maintenance period shall be suspended. The Contractor shall provide remedial work as directed by the Owner's Representative to correct the found deficiencies and schedule another review. If after the subsequent review the work is deemed acceptable, the maintenance period shall resume.

### 3.17 MAINTENANCE – MOWING AND DRESSING

- A. For new sod, mow when 1.125 inch tall and cut down to 0.75 inch.
- B. Turfgrass areas shall be mowed during the growing season a minimum of twice a week for warm-season varieties and a minimum of once a week for cool-season varieties, or at any time the grass reaches 1.4 times its mowing height. Turfgrass shall be edged weekly. The Contractor shall coordinate his watering and weed control schedules to accommodate his mowing schedule. If the Contractor is unable to mow the turf areas on the required day, he has until 5:00 pm of the next day to do the work. After that time, the Owner reserves the right to secure the services of an alternate mowing entity to perform the work. The cost for the alternate mowing will be deducted from monies owed to the Contractor. The Contractor will remain responsible to perform all scheduled mowings and maintenance of the site. The turfgrass shall be mowed and edged, and all trash and debris removed prior to Final Acceptance.
- C. Thirty days after the start of the maintenance period, the athletic field turfgrass shall be topdressed and dragged with USGA topdressing sand at a rate of 1.15 tons per 1,000 square feet (+0.25 inch depth). Drag and roll all topdressed turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface. Additional topdressing may be required later in the maintenance period if the finish grade planarity is not acceptable.

### 3.18 MAINTENANCE - FERTILIZATION

- A. The Contractor shall fertilize the warm-season turfgrass (Bermudagrass) at the start of the maintenance period and every twenty-eight (28) days with the turfgrass maintenance fertilizers at a rate of 0.75 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall allow for at least two separate fertilizer formulation applications in each fertilization operation. The Contractor shall continue

the fertilizer applications until the established turf is accepted.

- B. The Contractor shall fertilize the temporary cool-season turfgrass at the start of the maintenance period every twenty-eight (28) days with the turfgrass maintenance fertilizer at a rate of 0.5 lb. of actual N /1,000 s.f. and as modified by the soil fertility recommendations and as directed by the Landscape Architect. The Contractor shall allow for at least two separate fertilizer formulation applications in each fertilization operation. The Contractor shall continue the fertilizer applications until the established temporary turf is accepted.
- C. The Contractor shall fertilize the turfgrass areas during the last week of the maintenance period with the turfgrass maintenance slow-release N fertilizer (43-0-0) at a rate of three and one-half (3.5) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect. The Contractor shall allow for at least two separate fertilizer formulation applications in each fertilization operation.
- D. The Contractor shall fertilize the non-turf planted areas during the last week of the maintenance period with the mixed pre-planting fertilizer (14-6-11.6) at a rate of six (6.0) lbs./1,000 s.f. and as modified by the soil fertility recommendations and approved by the Landscape Architect. The Contractor shall allow for at least two separate fertilizer formulation applications in each fertilization operation.

### 3.19 MAINTENANCE – REPAIR AND WEEDING

- A. Between the twenty-first (21) day and the twenty-eighth (28) day after turfgrass planting, the Contractor shall perform the following: replant all spots or areas where normal germination or growth is not evident; remove all rocks or other debris that would constitute a hindrance to mowing or cultivating; repair all damage done by his operations. Where poorly compacted trench backfill shows settlement, remove turfgrass or plants, fill all depressions and eroded channels with sufficient conditioned topsoil to raise to proper grade, compact lightly and replant the filled areas. Roll all planted or replanted turfgrass areas with a lightly weighted turf roller in order to provide a smooth and even mowing surface.
- B. Visible weeds shall be removed at least weekly during the maintenance period. At the end of the maintenance period, all planting areas shall be without weeds. If weeds are present, the Contractor shall manually remove the weeds and shall then apply a granular, selective pre-emergent herbicide at manufacturer's approved rates. Coordinate application with the Owner's Representative and provide certificates of application to Owner's Representative. The turfgrass will be considered weed-free if there are 9 weeds or less per 50 square yards (one per 50 square feet).

### 3.20 FINAL REVIEW

- A. A Final Review will be made before the end of the Maintenance Period or upon the pending Final Acceptance of the work, whichever is earlier, provided all deficiencies revealed during the maintenance period have been corrected. If these deficiencies have not been corrected by the end of the stated maintenance period, the Contractor shall continue to fully maintain the project at his own expense. After all deficiencies have been corrected, a Final Review will be held with the Landscape Architect, Owner's Representative, and Contractor.
- B. If after the Final Review, the Landscape Architect and Owner's Representative are of the opinion that the work is acceptable and complete, the Contractor's maintenance responsibility shall terminate on an agreed upon date.

### 3.21 WARRANTY AND REPLACEMENT

- A. All trees and plants provided under this Contract shall be guaranteed to be in good, healthy, disease/pest free and in a flourishing condition one growing year from the date of Final Acceptance of the work, provided the Owner maintains the plants properly and in accordance with accepted horticultural practices. Species and size of any tree and/or plant replacements, either prior to or after Final Acceptance, shall be equal to that of the same adjacent trees and/or plants at the time of replacement as determined by the Landscape Architect.
- B. The Contractor shall be responsible to replace all lost plants due to theft, vandalism or any other preventable causes till Final Acceptance of the work by the Owner. Replacement trees and plants shall be planted as originally specified and detailed. Replacement trees and plants shall be guaranteed as specified above from the date of replacement. The maintenance period may be extended for a duration of not more than the original maintenance period duration for the establishment of replacement plants.
- C. The Contractor shall be held responsible for repair and/or replacement of damages to new or existing improvements resulting from the defects, storage or actions of trees, plants, materials, equipment or workmanship one year from the date of Final Acceptance or the Notice of Completion, whichever is later.

END OF SECTION

## SECTION 33 12 00 - WATER UTILITIES

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. Pipe and fittings for on-site domestic piping.
- B. Valves and valve boxes.
- C. Accessories.

## 1.2 RELATED SECTIONS

- A. Contract General Conditions and Division 01 Specifications.
- B. Section 31 11 00 - Site Clearing.
- C. Section 31 20 20 – Earthwork: Excavation, Filling, and Grading
- D. Section 31 22 22 - Soil Materials.
- E. Section 31 23 33 - Trench Excavation and Backfill.
- F. Section 32 13 13 - Site Concrete Improvements.

## 1.3 REFERENCES

- A. ASTM Test Method D1557.
- B. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
- C. ANSI/AWWA C110 - Ductile Iron and Grey-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
- D. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- E. ANSI/AWWA C500 - Gate Valves, 3-inch through 48-inch NPS, for Water and Sewage Systems.
- F. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water.
- G. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and Class 200.
- H. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
- I. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.



#### 1.4 SUBMITTALS

- A. Submit in accordance with Specification Section SUBMITTALS and the Contract General Conditions.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Contract General Conditions and Division 01 Specifications.
- B. Accurately record actual locations of piping mains, valves, connections and appurtenances, referenced to permanent surface features.
- C. Identify and describe discovery of uncharted utilities or utilities found at locations different than indicated on plans.

#### 1.6 QUALITY ASSURANCE

- A. Perform work in accordance with product manufacturer's recommendations and these Contract Documents.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle all products required.

### PART 2 - PRODUCTS

#### 1.1 WATER PIPE

- A. Ductile Iron Pipe (for iron pipe larger than 3 inches in diameter, above ground): ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
  - 1. Fittings: ANSI/AWWA C110/A21.10, ductile iron.
  - 2. Joints: Flanged.
- B. PVC Pipe (for pipe 3 inches and smaller, underground): ASTM D1785, Schedule 40.
  - 1. Fittings: ASTM D 2464, Schedule 80 PVC (ASTM D 2466, Schedule 40 PVC for pipes 1-1/2 inches and smaller).
  - 2. Joints: ASTM D 2855, solvent weld.

- C. PVC Pipe (for pipe 4 inches and larger, underground): ANSI/AWWA C900 Class 350.
  - 1. Fittings: ANSI/AWWA C111, ductile iron.
  - 2. Joints: ASTM D 3139 compression gasket ring.
- D. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed "CAUTION - WATER LINE BELOW".

## 2.2 VALVES - UP TO 2 INCHES (50 MM)

- A. Use full port ball valves for 2 inches and smaller and resilient wedge gate valves for 2-1/2 inches and larger size.
- B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.

## 2.3 GATE VALVES - 2-1/2 INCHES (63 MM) AND OVER

- A. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut or control handle wheel, resilient single wedge, threaded or flanged.

## 2.4 VALVE BOXES

- A. Precast Reinforced Concrete. Cast iron lid marked for service. Christy No. G5 or approved equal.
- B. Valve boxes shall have a minimum 6 inch wide by 4 inch (6" inches in vehicular areas) thick concrete collar.

## 2.5 ACCESSORIES

- A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Specification Section SITE CONCRETE IMPROVEMENTS.
- B. Valve Boxes and Covers: Christy No. G5 traffic box, or approved equal. Cover marking shall read "Water". A one-piece PVC riser extension shall be provided as necessary to allow unobstructed access to valve operating nut.
- C. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.
- D. Corrosion Protection: paint-on or tape-style wrap to be approved by the engineer of record

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Engineer.
- B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Unless dimensions are shown, drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between water systems, planting, and architectural features will be minimized.
- C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Engineer before proceeding.

### 3.2 PREPARATION

- A. Prepare for pipe installation by assembling all needed materials.
- B. Cover all PVC pipe during storage.

### 3.3 BEDDING

- A. Excavate trench, pit or hole in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.
- B. Where trench or pit has been overexcavated, place bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 8-inches loose uncompacted depth.
- C. Backfill around sides and to a level 12-inches above the top of pipe with bedding sand, tamped in place.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.

### 3.4 INSTALLATION - PIPE AND FITTINGS

- A. Install pipe at locations and depths indicated on plans.
- B. Install pipe, fittings, and associated materials in accordance with manufacturer's recommendations.
- C. Route pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings, not by bending.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.

- E. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change of direction in loose-joint pipe, per detail on plans.
- F. Establish elevations of buried piping to ensure not less than 30-inches of cover, except at connections to existing lines, which may be shallower or deeper, or where shown otherwise on plans.
- G. When two water pipes are to be installed in same trench, maintain a minimum 4-inch horizontal clearance between pipes.
- H. Backfill trench or other excavation in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL.

### 3.5 INSTALLATION - VALVES

- A. Set valves on solid bearing.
- B. Where valves are installed below finish surface grade, center and plumb valve box and any necessary extensions over valve. Set box cover flush with finished grade.
- C. Pour concrete collar around top of valve box per detail on plans.
- D. Furnish and install valves and valve boxes in addition to those shown on plans as required for isolation of lines for construction and disinfection, while minimizing disruption of service to buildings, at no additional cost to the Owner.

### 3.6 INSTALLATION - THREADED CONNECTIONS

- A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.
- B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel into plastic.
- C. A non-hardening sealant and lubricant similar to Permatex #51 or LASCO blue pipe sealant may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

### 3.7 CORROSION PROTECTION

- A. Provide corrosion protection for all metal structures below grade, installed per the manufacturers specifications

### 3.8 PRESSURE TESTING OF SITE WATER PIPING SYSTEM

- A. General: Unless otherwise directed, tests shall be witnessed by Inspector. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered

before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

- B. Water Piping: Pressure test all onsite water piping systems in accordance with AWWA Standard C605, "Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings". The pressure testing process shall be performed in cooperation with the authority having jurisdiction and witnessed by the Owner's Inspector. The constructor shall supply an affidavit of compliance to the Owner as required by AWWA Standard 605. Maintain 150 PSIG water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Flush all lines prior to pressure test.
- C. Backflow Preventer: All backflow preventers shall be tested according to manufacturer's recommendations and the USC Cross Connection Control and Hydraulic Research Manual latest edition and per local AHJ requirements. Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall provide written certification to the Architect showing the date in which the backflow preventers were tested and confirmation that unit passed all test requirements.

### 3.9 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect all domestic water piping systems in accordance with AWWA Standard C651, "Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by the Owner's Inspector. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner by the Owner's Inspector.

### 3.10 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the Contract General Conditions and Division 01 Specifications.
- B. Compaction testing of bedding and backfill will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest. Any retests required due to failure of initial tests shall be paid for by the Contractor.

END OF SECTION

## SECTION 33 30 00 - SITE SEWER SYSTEMS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. Sanitary Sewer Pipelines and Fittings
- B. Site Accessories

## 1.2 RELATED SECTIONS

- A. All Division 01 Specification Sections.
- B. Section 31 11 00 - Site Clearing
- C. Section 31 20 00 - Earthwork: Excavation, Filling, and Grading
- D. Section 31 22 22 - Soil Materials
- E. Section 31 23 33 - Trench Excavation and Backfill
- F. Section 32 13 13 - Site Concrete Improvements

## 1.3 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies
  - 1. Safety Regulations: Work shall comply with all Federal, State and Municipal regulations regarding safety, including the requirements of the following:
    - a. William-Steiger Occupational Safety & Health Act of 1970.
    - b. State of California, California Administrative Code, Title 8 Industrial Relations, Chapter 4, Subchapter 4, "Construction of Safety Orders" and other State and local agencies having jurisdiction.
    - c. All trenching work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission.

## 1.4 REFERENCES

- A. American Water Works Association (AWWA).
- B. American Society for Testing and Materials (ASTM):
  - 1. Designation D3034 - Polyvinyl Chloride (PVC) pipe.
- C. California Plumbing Code, Latest Edition (CPC).
- D. Local County Health Department Standards.

## 1.5 SUBMITTALS

- A. Submit under provisions of Specification Section - SUBMITTAL PROCEDURES. Certificates of compliance for material
- B. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- C. Submit manufacturer's data and/or fabrication drawings for Sanitary Sewer Pipelines, Sanitary Sewer Manholes and Sanitary Sewer Fittings, installed under this Section. No items shall be incorporated into the work until submittals are approved by the Engineer.

## 1.6 COORDINATION

- A. Verify location of existing utilities have been indicated at by local utility authorities.

## 1.7 EXISTING UTILITIES

- A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by local utility authorities.
- D. Maintain all existing utility mains and service lines in constant service during construction of the Work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Sanitary sewer pipelines for pipes 4 inches and larger shall be polyvinyl chloride (PVC) pipe conforming to ASTM Designation 3034, SDR-35, with elastomeric gasket joints per ASTM D 3212 and F477.
- B. Sanitary sewer pipelines for pipe less than 4 inches shall be Schedule 40 PVC pipe, ASTM D1785.

- C. All sanitary sewer fittings shall be watertight connections using PVC sewer fittings as approved by the California Plumbing Code, or approved equal to be determined by the Civil Engineer.
- D. Surface cleanout shall be precast concrete with cast iron lid marked for service Christy G5 or approved equal and constructed as per detail drawing and current plumbing code.
- E. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed "CAUTION - SEWER LINE BELOW".

### PART 3 - EXECUTION

#### 3.1 CLEARING OF WORK SITE FOR SITE IMPROVEMENTS

- A. Clear site for improvements per construction drawing demolition plan and in accordance with Specification Section SITE CLEARING.

#### 3.2 TRENCH EXCAVATION

- A. Trench excavation and backfilling shall be in accordance with Specification Section TRENCH EXCAVATION AND BACKFILL and construction drawing detail.

#### 3.3 SOIL MATERIALS

- A. Excavated materials and imported materials shall meet engineering recommendations in accordance with Specification Section SOIL MATERIALS.

#### 3.4 PIPE INSTALLATION

- A. Pipe Laying: Alignment and elevation stakes shall be set at intervals with offsets and cut to the invert of the pipe.
  - 1. Proper facilities shall be provided for stringing and lowering sections of pipe into the trench. The pipe shall be laid carefully to lines and grades given.
  - 2. The grade line shown on the plans indicates the flow line or invert of the pipe and all cuts, unless otherwise indicated, refer to this line.
  - 3. After the trench for pipe has been brought to the proper line and grade, the pipe shall be laid in the following manner.



- a. Pipe laying shall proceed upgrade with the bell ends of bell and spigot pipe placed upstream. Each section of pipe shall be laid to line and grade as herein specified and in such a manner as to form a watertight, concentric joint with the adjoining pipe. The interior of the pipe shall be cleared of all dirt and debris and excess joint sealing material as the work progresses. Pipe shall not be laid when the condition of the trench or weather is unsuitable. All open ends of pipe and fittings shall be adequately and securely closed whenever the work is discontinued for more than one-half hour. If pipe with elliptical or quadrant reinforcement is used, care shall be taken to properly orient the axis.
  4. All joint surfaces shall be cleaned before joints are made.
  5. The Contractor shall furnish and use, for grade and alignment control, a laser beam system which complies with OSHA requirements. The laser system shall have good visibility when used with suitable target material. The laser system must be of the self-leveling type so that the laser beam is automatically compensated for minute grade disturbances.
  6. The laser system must also have an early warning system that instantly warns the pipe layer when the laser is off grade. The laser system is to be provided by the Contractor and shall have a minimum accuracy of  $\pm 0.01$  foot per one hundred feet (100') on line; and a minimum visible range of one thousand feet (1000'). When conditions are such that this method is impractical, such as on short pipe runs, the Contractor shall have an Engineer on the ground to set grade of each joint of pipe by means of an Engineer's level.
- B. Sewer Systems Plugs: Temporary plugs of brick or mortar shall be installed on all sewer projects at points of connection to existing facilities. These plugs shall remain in place until completion of the balling and flushing operation. The plugs, intended to prevent water from the balling and flushing operation, drainage, or any other condition from entering the existing system, shall be installed or removed in the presence of and under the direct supervision of the Engineer. Until the system has been pumped clear of accumulated water, the plugs shall not be removed. This water must not be allowed to enter adjacent sewer or drainage systems.
- C. Internal Inspection: Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which in the opinion of the Engineer resulted from the new installation, shall also be removed by the Contractor. Sewer pipes shall be cleaned by the controlled balling method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt, and debris from entering the existing facility. Temporary plugs for sewer systems shall also conform to Subsection B, above. Water from the drainage system operations shall be routed through a suitable trap to collect any dirt and debris prior to discharging into any downstream facility. The Contractor shall notify the Architect immediately after completion of the pipe cleaning operations. Cleaning of drainage pipes by the controlled balling method will not be required.
- D. As soon as possible after the completion of the pipe cleaning, and prior to final acceptance, the Architect or Engineer may make a visual internal inspection of the new pipeline either manually or with television equipment.

### 3.5 COORDINATION

- A. Coordinate with the campus for the shutdown of the existing sewer system to make new sewer connection. Install sewer pipelines before making tie-in to the existing sewer pipeline. Tie-in work may proceed during the campus non-use of the existing sewer system such as on weekends.

### 3.6 TESTING OF SANITARY SEWERS

- A. After cleaning per Section 3.4-C, each section of sewer constructed shall be tested in accordance with acceptable "Low Pressure Air Test for Sanitary Sewers" methods such as presented in the Journal of Sanitary Engineering, Division ASCE, April 1964, to test the point of effluent disposal. All lines and components shall be leak proof.

### 3.7 INSPECTION OF SANITARY SEWERS

- A. System components shall be properly identified as to the manufacturer.

### 3.8 CLEAN-UP

- A. Remove from the site all rubbish, debris, etc. in a lawful manner, resulting from work in this Section. The clean-up shall include the replacement and repair of any damaged or disturbed property.

END OF SECTION

## SECTION 33 40 00 - STORM DRAINAGE

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY:

- A. This section includes the following:

- 1. Provide all materials, labor, equipment and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

- B. RELATED SECTIONS:

- 1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 00 and 01 sections, apply to this work.
  - 2. Section 31 22 22 – Soil Materials
  - 3. Section 31 23 33 – Trench Excavation and Backfilling.
  - 4. Section 32 13 13 – Site Concrete Improvements.

## 1.3 REFERENCES

- A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- B. ANSI/ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- C. ANSI/ASTM C478 Precast Reinforced Concrete Manhole Sections.
- D. ASTM D1557

## 1.4 DEFINITIONS

- A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.
- B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Certificates of compliance for material.
- C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- D. Submit manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this Section. No items shall be incorporated into the work until submittals are approved by the Architect/Engineer

### 1.6 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Owner's personnel.
- C. Coordinate work with other project work.

### 1.7 EXISTING UTILITIES

- A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by Owner's personnel.
- D. Maintain all existing utility mains and service lines in constant service during construction of the Work

### 1.8 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Accurately record actual locations of utilities encountered.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Reinforced Concrete Pipe for pipe larger than fifteen (15) inches: ANSI/ASTM C76, Class 3, with rubber gasket joints per ANSI/ASTM C443.
- B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35, with elastomeric gasket joints per ASTM D 3212 for pipe fifteen (15) inches or less.
- C. Storm drainage pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM D1785, Schedule 40, for pipe three (3) inches or less.
- D. Poured in Place Concrete: Specification Section SITE CONCRETE IMPROVEMENTS.
- E. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.
- F. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.
- G. Soil Fill for Concrete Pipe Bedding Envelope: Specification Section TRENCH EXCAVATION AND BACKFILL.
- H. Catch basins and drain inlets shall be constructed as per detail drawing.
- I. Concrete collar shall be constructed as per detail drawing.
- J. Cleanout shall be constructed as per detail drawing.
- K. All metallic pipe, fittings and appurtenances in contact with soil shall be coated or wrapped with an approved material, as required to protect it from corrosive soil.
- L. All changes in direction in the pipe alignment that do not occur at a structure shall be accommodated with PVC wye fittings as approved by the California Plumbing Code, or approved equal
- M. Locator Tape: Tape shall be an inert material such as polyethylene plastic with a metallic core, and highly resistant to alkalis, acids, or other chemical components likely to be encountered in soils. The tape shall be bright colors for contrast with the soils with identifying print in black letters. The tape shall be six inches wide and be printed "CAUTION – STORM SEWER LINE BELOW".
- N. Corrosion Protection: paint-on or tape-style wrap to be approved by the engineer of record

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify site conditions.

#### 3.2 PREPARATION

- A. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures and other improvements to remain from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow, and provide drainage to all excavated areas. Dewater existing drainage basins and existing drainage pipeline systems as necessary to accomplish the work.
- G. Comply with safety requirements as they pertain to excavations, per Specification Section EARTHWORK.
- H. Remove all interfering surface and subsurface improvements authorized for removal.

#### 3.3 EXCAVATION

- A. Excavate soil required to locate existing utilities and install the work.
- B. Excavate trenches and pits per Specification Section EARTHWORK.
- C. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.
- D. Excavate trench to depth which is 6 inches below the outside bottom of the pipe barrel to be placed therein.
- E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.
- F. Provide protection to public per Division 01.

### 3.4 INSTALLATION AND BEDDING OF STORM DRAIN PIPE

- A. Install the pipe and fittings to the lines and grades shown on the construction plans.
- B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.
- C. Unless otherwise approved by the Engineer, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.
- D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.
- E. Ensure that all joints are properly "homed" and are watertight.
- F. Bed concrete pipe in backfill or sandfill soil envelope, and compact to a minimum of 90% relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6 inches below the outside bottom of the pipe barrel) to a level 6 inches above the outside top of the pipe barrel.

### 3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTANCANCES

- A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.
- B. Construct poured-in-place concrete per Specification Section SITE CONCRETE IMPROVEMENTS.
- C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.
- D. Construct cleanout, outfall structure per detail drawing.

### 3.6 CORROSION PROTECTION

- A. Provide corrosion protection for all metal structures below grade, installed per the manufacturers specifications

### 3.7 BACKFILLING TO FINISHED GRADE AND FINISHED GRADING

- A. Place and compact backfill per Specification Section TRENCH EXCAVATION AND BACKFILL.
- B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.
- C. In areas to receive paving or a significant thickness of sealing material, temporarily set manhole frame and cover below finish grade, then return after final surfacing and/or pavement sealing and bring manhole frame and cover to final grade, as shown on the plans.

- D. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans.
- E. Rake and smooth all finished dirt surfaces.

### 3.8 TOLERANCES

- A. Pipe laying tolerances:
  - 1. Above grade: Not to exceed 1/4-inch above planned grade.
  - 2. Below grade: Not to exceed 1/2-inch below planned grade.
  - 3. Alignment: Not to exceed 2 inches from planned alignment, if gradual and regular over a distance of 20 feet.
- B. Structure finish grade tolerance: Within 1/4 inch of planned grade, but must match adjacent improvements.

### 3.9 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 01.
- B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest at no additional cost to Owner.

END OF SECTION



## FUGITIVE DUST CONTROL

### SECTION 44 11 13 – DUST CONTROL

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following:
1. Provide all material, labor, fees, and services necessary to comply with the San Joaquin Valley Air Pollution Control District (SJVAPCD) Regulation VIII for dust control requirements.
  2. Contractor will determine the total disturbed surface area and the estimated bulk material moving volumes anticipated for the Project to determine if a Construction Notification or Dust Control Plan is required. Contractor shall prepare and submit a Construction Notification or Dust Control Plan to the SJVAPCD based on these expected Project conditions/activities.
  3. Non-residential Projects that will include five acres or more of disturbed surface area and/or will be moving, depositing, or relocating more than 2,500 cubic yards of bulk material on at least three days of the project are required to submit a Dust Control Plan to the SJVAPCD and receive approval prior to commencing earth moving activities.
  4. Non-residential projects that will include less five acres of disturbed surface area must submit a Construction Notification at least 48 hours prior to commencement of any earthmoving activities. No approval or response from the SJVAPCD is required.
  5. Contractor shall be solely responsible for payment of any fees or fines related to violations of SJVAPCD Regulation VIII from Project activities/conditions.
  6. All Contract requirements in Division 00 and 01 specifications.
- B. This Section does not include:
1. None.
- C. Acronyms:
1. SJVAPCD                      San Joaquin Valley Air Pollution Control District

##### 1.2 REFERENCES

- A. SJVAPCD Compliance Assistance Web Page on Dust Control:
1. <https://ww2.valleyair.org/compliance/dust-control/>
- B. SJVAPCD Regulation VIII
1. <https://ww2.valleyair.org/rules-and-planning/current-district-rules-and-regulations/regulation-viii-fugitive-pm10-prohibitions/>

##### 1.3 RELATED SECTIONS

- A. Section 31 11 00 – Site Clearing
- B. Section 31 20 00 – Earthwork
- C. Section 01 57 23 – Stormwater Pollution Prevention Plan

## FUGITIVE DUST CONTROL

### 1.4 SUBMITTALS

- A. If applicable, Contractor shall submit to the SJVAPCD the Project Dust Control Plan at least 30 days prior to commencing earth moving activities.
- B. If applicable, Contractor shall submit to the SJVAPCD the Project Construction Notification at least 48 hours prior to commencing earth moving activities.
- C. Contractor shall submit to Owner the Project Dust Control Plan approved by the SJVAPCD or documentation of submission of a Construction Notification to SJVAPCD prior to commencing earth moving activities.

### 1.5 REQUIREMENTS

- A. Comply with all requirements of SJVAPCD Regulation VIII throughout the life of this contract.
- B. The Contractor shall be fully aware of the requirements of SJVAPCD Regulation VIII, the requirements of these specifications for preparing, implementing, maintaining, and enforcing the provisions of SJVAPCD Regulation VIII, and the impact that Regulation VIII will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with SJVAPCD Regulation VIII is a violation of local regulations. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Regulation VIII arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Regulation VIII requirements.

### 1.6 QUALITY ASSURANCE

- A. None.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Dust Management Practices (DMPs):
  - 1. The Contractor is responsible for the providing and furnishing all DMPs, products, and practices necessary to comply with Regulation VIII. All materials and DMPs shall follow the requirements outlined in Regulation VIII, Rule 8021.

## PART 3 - EXECUTION

### 3.1 FIELD QUALITY CONTROL

- A. Dust Control Training Class Certificate:
  - 1. At least one key individual representing the Contractor who prepares a Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.

## FUGITIVE DUST CONTROL

2. At least one key individual representing the Contractor who is tasked to implement the Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.

### 3.2 CLEANING AND REMOVAL

- A. All temporary DMPs shall be completely removed from the Project Site upon completion of construction.

### 3.3 RECORD KEEPING

- A. If a Dust Control Plan applies to the Project, Contractor shall maintain records in accordance with the recordkeeping requirements of Regulation VIII, Rule 8011.

### 3.4 PAYMENT

- A. Full compensation for all costs involved in preparing, submitting, implementing, and monitoring the implementation of Regulation VIII for this project, including training, performing corrective measures, providing all labor, materials, resources to maintain the site, and all required records for a Dust Control Plan (if applicable), and being full liable for all failures to fulfill the intent and requirements of the Regulation VIII set forth by the SJVAPCD, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION

# APPENDIX A

# STORMWATER POLLUTION PREVENTION PLAN

for

CCC Sports Complex

**Project Location:**

Fresno, CA

**RISK LEVEL: 1**

**Legally Responsible Person (LRP):**

State Center Community College District

1171 Fulton St, Fresno, CA 93721.

Darren Cousineau

(559) 265-5745

**Project Address:**

10309 N. Willow Ave., Fresno, CA 93730

**SWPPP Prepared by:**



CONSULTING ENGINEERS

Gabriel Ledesma

451 Clovis Avenue #200, Clovis, CA 93612

**SWPPP Preparation Date:**

October 28, 2024

WDID #	TBD
Application ID	576874

Estimate Construction Dates
01/14/2025 - 05/06/2026

Site Operation Hours
7AM – 5PM, M-F

Contact	Name	Phone Number	License/Certification #
Qualified SWPPP Developer	Gabriel Ledesma	(559) 326-1400	#28909
Co-Qualified SWPPP Developer	Michael Gennaro	(559) 326-1400	#28547
Qualified SWPPP Practitioner			
QSP Trained Delegates			
QSP Trained Delegates			

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# List of Acronyms

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AS	Approved Signatory
ATS	Active Treatment System
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practices
CFR	Code of Federal Regulations
CGP	NPDES 2022 CGP for Storm Water Discharges Associated with Construction Activities
COC	Chain of Custody
CPESC	Certified Professional in Erosion and Sediment Control
CPSWQ	Certified Professional in Storm Water Quality
CSMP	Construction Site Monitoring Plan
CWA	Clean Water Act
DAR	Duly Authorized Representative
DWQ	Division of Water Quality
EPA	Environmental Protection Agency
FMFCD	Fresno Metropolitan Flood Control District
LRP	Legally Responsible Person
MRR	Monitoring and Reporting Requirements
MS4	Municipal Separate Storm Sewer System
NAL	Numeric Action Level
NEL	Numeric Effluent Limitation
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
PRDs	Permit Registration Documents
QPE	Qualifying Precipitation Event
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
RUSLE2	Revised Universal Soil Loss Equation, Version 2
RW	Receiving Water
RWQCB	Central Valley Regional Water Quality Control Board (Fresno Office)
SMARTS -	Storm Water Multi Application Reporting and Tracking System
SSC	Suspended Sediment Concentration
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
WDID	Waste Discharge Identification Number
WQO	Water Quality Objective

# Qualified SWPPP Developer (QSD)

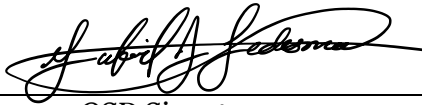
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## Approval and Certification of the Stormwater Pollution Prevention Plan

Project Name: \_\_\_\_\_ CCC Sports Complex

Project Number/ID: \_\_\_\_\_ **TBD**

“This Stormwater Pollution Prevention Plan and its appendices were prepared under my direction to meet the requirements of the California Construction Stormwater General Permit (*Order No. 2022-0057-DWQ*). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below and will maintain up to date credentials for the duration of the project.”



\_\_\_\_\_  
*QSD Signature*

October 28, 2024

\_\_\_\_\_  
*Date*

Gabriel Ledesma

\_\_\_\_\_  
*QSD Name*

28909

\_\_\_\_\_  
*QSD Certificate Number*

QSD, CPESC, Environmental Specialist at Blair,  
Church & Flynn Consulting Engineers

\_\_\_\_\_  
*Title and Affiliation*

(559) 326-1400

\_\_\_\_\_  
*Telephone Number*

[gledesma@bcf-engr.com](mailto:gledesma@bcf-engr.com)

\_\_\_\_\_  
*Email*

## Qualified SWPPP Practitioner (QSP)

---

Project Name: \_\_\_\_\_ CCC Sports Complex

Project Number/ID: \_\_\_\_\_ **TBD**

The QSP identified below shall complete and oversee the implementation and documentation of the construction site monitoring plan elements (CSMP) contained in this Stormwater Pollution Prevention Plan and the California Construction Stormwater General Permit (*Order No. 2022-0057-DWQ*). The QSP shall complete all documentation truthfully and shall not misrepresent their qualifications or active certificate status while acting as the QSP for the Project.

_____	_____
<i>QSP Signature</i>	<i>Date</i>
_____	_____
<i>QSP Name</i>	<i>QSP Certificate Number</i>
_____	_____
<i>Title and Affiliation</i>	<i>Telephone Number</i>
_____	
<i>Email</i>	

## Amendment Log

---

Project Name: CCC Sports Complex

Project Number/ID: TBD

Amendment No.	Date	Brief Description of Amendment (include section and page number)	Prepared and Approved By
			Name: QSD#
			Name: QSD#
			Name: QSD#

The SWPPP will be revised when:

- There is a 2022 CGP violation (2022 CGP Section VI.Q.1);
- There is a reduction or increase in total disturbed acreage (2022 CGP Section III.F.2. and F.4);
- BMPs are not effective and are not resulting in a reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges (2022 CGP Section VI.Q.1 and Attachment E Section III.C.5);
- There is a change in the project duration that changes the project Risk Type (2022 CGP Section III.F.1);
- Dischargers with projects where all construction activities (including passive treatment, active treatment systems, and/or active equipment) will be suspended for 30 days or more (2022 CGP Section III.G).

# Section 1 SWPPP Requirements

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## 1.1 INTRODUCTION

This Stormwater Pollution Prevention Plan (SWPPP) is designed to comply with California's *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (2022 CGP)*, State Water Resources Control Board (State Water Board) *Order No. 2022-0057-DWQ (NPDES No. CAS000002)* (Appendix R). This SWPPP has been prepared following the 2022 CGP SWPPP Template for Traditional Projects provided in the California Stormwater Quality Association (CASQA) *Stormwater Best Management Practice (BMP) Handbook: Construction (CASQA 2023)*.

This project is considered a traditional construction project.

In accordance with the 2022 CGP, Section IV.O, this SWPPP is designed to address the following:

- Identification of all pollutants, their sources, and control mechanisms, including sources of sediment associated with all construction activities (e.g., sediment, paint, cement, stucco, cleaners, site erosion);
- Pollutant source assessments, including a list of potential pollutant sources and identification of site areas where additional BMPs are necessary to reduce or prevent pollutants in stormwater and authorized non-stormwater discharges, per the minimum requirements when developing the pollutant source assessment;
- Description of site-specific BMPs implemented to reduce or eliminate stormwater pollution;
- Where not otherwise required to be under a Regional Water Quality Control Board (Regional Water Board) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated;
- Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard; and;
- Stabilization BMPs are installed to reduce or eliminate pollutants after construction is completed are effective and maintained; and
- Calculations and design details, as well as BMP controls, are complete and correct.

The CCC Sports Complex project (Project, or Site) comprises approximately 8.65 acres, of which 8.51 acres will be disturbed. The Project is located at 10309 N. Willow Ave., Fresno, CA 93730. The property is owned and being developed by State Center Community College District. The project's location is shown on the Site Maps in Appendix A.

The State Center Community College District (SCCCD) plans to develop the southern portion of the Clovis Community College campus in Northeast Fresno. The Project includes a new track and field stadium, stadium entry, restrooms, bleachers, and accessible stalls in the adjacent parking lot to the northeast of the Project location. Construction activities include demolition of existing sidewalk and pavement, vegetation removal, and grading, installation of underground utilities, and construction of the track and field facility.

## **1.2 PERMIT REGISTRATION DOCUMENTS**

Required Permit Registration Documents (PRDs) shall be submitted to the State Water Board via the Stormwater Multi Application and Report Tracking System (SMARTS) by the LRP or DAR. The project-specific PRDs include (2022 CGP Section III.A):

1. Notice of Intent (NOI);
2. Risk Level Determination (Construction Site Sediment and Receiving Water Risk Determination);
3. Site Drawings and Map;
4. SWPPP;
5. Applicable plans, calculations, and other supporting documentation for compliance with the Phase I or Phase II municipal separate storm sewer system (MS4) post construction requirements or the post-construction standards of the 2022 CGP:
  - Attachment or web-source containing the applicable Phase I or Phase II MS4 post construction requirements;
  - The post construction plans and calculations submitted to or approved by the applicable Phase I or Phase II MS4; and/or
  - Post-construction water balance calculation;
6. Dischargers proposing an alternate K-factor or LS-factor must submit documentation to support the site-specific factors, if applicable;
7. Active Treatment System (ATS) Plan, if applicable;
8. Passive Treatment Plan, if applicable;
9. Dewatering Plan, if applicable;
10. Annual Fee per the current 23 California Code of Regulations Chapter 9 fee schedule for National Pollutant Discharge Elimination System (NPDES) stormwater permits; and
11. Signed Certification Statement (LRP Certification is provided electronically with SMARTS PRD submittal).

Site Maps can be found in Appendix A. A copy of the submitted PRDs shall also be kept in Appendix B along with the Waste Discharge Identification (WDID) confirmation.

## **1.3 SWPPP AVAILABILITY AND IMPLEMENTATION**

The SWPPP will be available at the construction site during working hours list on the title sheet and Section 7.5, while construction is occurring and shall be made available upon request by a federal, state, or municipal inspector. A current copy of the site-specific SWPPP and any site inspection reports required by the 2022 CGP may be kept in electronic format at the site so long as the information requested by a federal, state, or municipal inspector can be made available during an inspection. Legible maps in hard copy must be available at the site (2022 CGP Section IV.O.1.).

The SWPPP must be implemented at the appropriate level to protect water quality at all times throughout the life of the project. The SWPPP must remain on the site during construction activities, commencing with the initial mobilization and ending with the termination of coverage under the 2022 CGP.

## **1.4 SWPPP AMENDMENTS**

The SWPPP will be revised when:

- If there is a 2022 CGP violation (2022 CGP Section VI.Q.1);
- There is a reduction or increase in total disturbed acreage (2022 CGP Section III.F.2 and F.4.);
- BMPs are not effective and are not resulting in a reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges (2022 CGP Section VI.Q.1 and Attachment D Section III.C.5);
- There is a change in the project duration that changes the project's risk level (2022 CGP Section III.F.1); or
- Dischargers with projects where all construction activities (including passive treatment, active treatment systems, and/or active equipment) will be suspended for 30 days or more (2022 CGP Section III.G.).

Additionally, the SWPPP will be amended when:

- There is a change in construction or operations that may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4) (2022 CGP Sections IV.O. and VI.Q.1); or

When deemed necessary by the QSD. The QSD has determined that the changes listed in Table 1-1 can be field determined by the QSP. All other changes will be made by the QSD as formal amendments to the SWPPP. Note that the 2022 CGP requires that the QSD revise the SWPPP to address potential problems identified by visual inspections, sampling data, comments from a QSP, or their own site observations (2022 CGP Section V.C.2.).

The following items shall be included in each amendment:

- Who requested the amendment;
- The location of proposed change;
- The reason for change;
- The original BMP(s) proposed, if any;
- The new BMP(s) proposed; and
- QSD certification.

SWPPP amendments will be logged at the front of the SWPPP and SWPPP Amendment QSD certifications will be located in Appendix C. The SWPPP text will be revised, replaced and/or hand annotated as necessary to properly convey the amendment. SWPPP amendments must be made by a QSD. The following changes have been designated by the QSD as "to be field determined" and constitute minor changes that the QSP may implement based on field conditions.

**Table 1-1 List of Changes to be Field Determined**

Candidate changes for field location or determination by QSP <sup>(1)</sup>	Indicates changes that may be field located or field determined by QSP/Delegates	
Increase quantity of Erosion or Sediment Control Measures	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Relocate/Add stockpiles or stored materials	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Relocate/Add toilets – Shall include a containment tray	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Relocate vehicle storage and/or fueling locations	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Relocate concrete waste management facilities	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Relocate areas for waste storage	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Relocate water storage and/or water transfer location	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Changes to access points (entrance/exits)	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Change type of Erosion or Sediment Control Measures – Changes may only include BMPs indicated within Section 3.1 of this SWPPP	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Changes to location of Erosion or Sediment Control Measures	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Minor changes to schedule or phases	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Changes in construction materials	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
<i>(1) Any field changes not identified for field location or field determination by the QSP must be made as an amendment by the QSD.</i>		

## 1.5 RETENTION OF RECORDS

Paper or electronic records of documents required by this SWPPP will be retained for a minimum of three years from the date generated or date submitted, whichever is later, for the following items:

- SWPPP;
- Visual monitoring reports;
- Sampling equipment calibration records;
- pH and turbidity sampling field sheets;
- Analytical laboratory reports; and
- QSP training records of Contractor staff for BMP implementation, installation, and maintenance
- QSP delegate training records, if applicable

These records will be available at the Site until construction is complete. Records assisting in the determination of compliance with the 2022 CGP will be made available within a reasonable time to the Regional Water Board, State Water Board, or U.S. Environmental Protection Agency (EPA) upon request. Requests by the Regional Water Board for retention of records for a period longer than three years will be adhered to.



## **1.6 REQUIRED REPORTING**

Completed inspection checklists are not required to be submitted to the Regional Water Board. However, completed inspection checklists will be kept with the SWPPP on-site or electronically and provided to the LRP upon termination of the SWPPP. The 2022 CGP requires that permittees prepare, certify, and electronically submit an Annual Report no later than September 1 of each year. Reporting requirements are identified in 2022 CGP Section VI.P. Annual reports will be filed in SMARTS and in accordance with information required by the online forms.

Planned changes in site construction activities that may result in non-compliance with the 2022 CGP are required to be provided in writing to the Regional Water Board and local stormwater agency in advance of the changes.

If a 2022 CGP discharge violation occurs, the QSP will immediately notify the LRP. The LRP will include information on the violation with the Annual Report. Corrective measures will be implemented immediately following identification of the discharge or written notice of non-compliance from the Regional Board. Discharges and corrective actions must be documented and include the following items:

- The date, time, location, nature of operation, and type of unauthorized discharge;
- The cause or nature of the notice or order;
- The BMPs deployed before the discharge event, or prior to receiving notice or order; and
- The date of deployment and type of BMPs deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent re-occurrence.

The Project is located in the Central Valley (Fresno) Regional Water Quality Control Board which has no water bodies with TMDL NALs and/or NELs, so there are no applicable TMDL NALs and/or NELs for the Project.

The Project will not use an Active Treatment System so there are no applicable NELs for the Project.

The Regional Water Board will be notified via email 24 hours prior to the beginning of a planned dewatering discharge. The Fresno Metropolitan Flood Control District (FMFCD) shall also be notified if dewatering will direct discharges to FMFCD storm drains.

In the event of an emergency dewatering, the Regional Water Board and applicable MS4 are to be notified within 24 hours of a discharge occurring. An emergency is defined as the need to protect human life and health or prevent severe property damage.

Results of (pH and turbidity, etc.) monitoring will be electronically submitted through SMARTS for all field sampling results within 30 days of the completion of the precipitation event or within 10 days if the field sampling results demonstrate the exceedance of the pH and/or turbidity NALs.

See Section 7.7.4.5 for additional discussion of the reporting requirements including contacts for Regional Water Board and MS4 notifications.

The Project will not utilize Passive Treatment so there is no Passive Treatment Plan for the Project.

## **1.7 CHANGES TO PERMIT COVERAGE**

The 2022 CGP allows for the reduction or increase of the total acreage covered under the 2022 CGP when: a portion of the project is complete and/or conditions for termination of coverage

have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

Modified PRDs will be filed electronically through a Change of Information (COI) within 30 days of a reduction or increase in total disturbed area if a change in permit-covered acreage is to be sought. The SWPPP will be modified appropriately and will be logged at the front of the SWPPP. SWPPP Amendments QSD Certifications will be located in Appendix C. COIs submitted electronically via SMARTS can be found in Appendix D.

## **1.8 NOTICE OF TERMINATION**

A Notice of Termination (NOT) must be submitted electronically by the LRP or DAR via SMARTS to terminate coverage under the 2022 CGP.

According to the requirements of 2022 CGP Section III.H.4., the one or more of the following final stabilization method will be used to satisfy final stabilization condition requirements:

- 70 percent final cover method supported by pre- and post-project photographs demonstrating stabilization.
- RUSLE or RUSLE2 method with computation proof supported by pre- and post-project photographs demonstrating stabilization.
- Custom method for which Regional Water Board approval has been obtained, supported by documentation required by the Regional Water Board and pre- and post- project photographs demonstrating stabilization.

The Regional Water Board will consider a construction site complete when the conditions of the 2022 CGP Section III.H., have been met.

The discharger is required to submit the following in SMARTS:

- NOT SMARTS Form;
- QSP-prepared final NOT inspection which includes the QSP name and valid QSP certificate number;
- Final site map with photo orientation references;
- Photos demonstrating final stabilization and the applicable post-construction BMPs and/or low impact development; and
- A long-term maintenance plan for the post-construction stormwater runoff BMPs and/or low impact development features being implemented.

According to the 2022 CGP, the NOT will be automatically approved within 30 calendar days after the date the NOT was submitted, unless, within the 30 calendar days the Regional Water Board notifies the discharger through SMARTS that the Notice of Termination has been denied, returned, or accepted for review (2022 CGP Section III.H.7).

Note: If an Annual Report has not been filed in the current reporting year, an Annual Report will need to be submitted prior to the NOT.

## Section 2 Project Information

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### 2.1 PROJECT AND SITE DESCRIPTION

#### 2.1.1 Site Description

The CCC Sports Complex project site is Risk Level 1, comprises approximately 8.65, and is located at 10309 N. Willow Ave., Fresno, CA 93730. The project site is located approximately 3.25 miles east of Hwy 41, and 3.5 miles northwest of Hwy 168. The project site is located approximately 1 mile northeast of FMFCD's stormwater retention basin, Basin "R," and approximately 3 miles east of the San Joaquin River. The project is located at 36.882281, -119.733961 and is identified on the Site Map in Appendix A.

#### 2.1.2 Existing Conditions

As of the initial date of this SWPPP, the project site is a vacant lot that is disced occasionally to create fire breaks. A portion of the site includes an existing road and parking lot to the northeast of the main project site. The developed campus is to the north with paved access roads adjacent to the site. No structures are present except underground storm drain pipes and a parking area at the northeast corner. The project site was previously developed with rural residential and agricultural uses including row crop and orchard cultivation.

There are documented investigations of historical sources of potential soil contamination at the project associated with its past agricultural uses. Specifically, there are two (2) sites in the vicinity of the Project (within an approximate 5,000 foot radius) where Preliminary Endangerment Assessment (PEA) reports are available through the Department of Toxic Substances Control (DTSC) *Envirostor* database. Based on the PEA reports provided to the DTSC, the DTSC issued "no further action" (NFA) determinations for both sites, concurring that no actual or potential hazardous materials release was indicated which would pose a threat to human health or the environment under any land use (California Department of Toxic Substances Control, 2024). Since this case is resolved with DTSC, there is no concern of soil contamination at the Project site.

There is record of one (1) Leaky Underground Storage Tank (LUST) approximately 3,000 feet north of the Project site, according to the SWRCB's GeoTracker database. According to the GeoTracker database, this incident involved gasoline and was resolved in 1989 (State Water Resources Control Board, 2024).

#### 2.1.3 Existing Drainage

The project site is relatively level, though its eastern perimeter slopes towards the adjacent road to the east, and its southern perimeter slopes towards Behymer Ave. to the south. The elevation of the project site ranges from 381 to 376 feet above mean sea level (msl). Surface drainage for the majority of the site that comprises of a vacant lot currently flows in no single direction and surface drainage likely ponds on-site. However, the eastern and southern perimeters of the vacant lot are sloped towards the developed roads adjacent to the site. Additionally, surface drainage from the parking lot to the northeast flows to nearby storm drains.

Any stormwater that discharges from the site flows through curb and gutter towards storm drains that convey flows to the Fresno Metropolitan Flood Control District's (FMFCD) stormwater drainage system. The stormwater drainage system conveys flows towards an FMFCD retention basin, Basin "R," which may discharge to a Fresno Irrigation District canal, the Teague Canal, during the wet weather season or during occasional maintenance operations.

Existing site topography, drainage patterns, and stormwater conveyance systems are shown on Site Maps Figure 2 in Appendix A.

The project discharges to FMFCD stormwater retention basin, Basin “R”, which may discharge to the Teague Canal during the wet weather season or during maintenance operations. The water quality impairments (303 (d) list and TMDLs identified in the 2022 CGP Table H-1 for the receiving waters are identified in the Table 2-1.

**Table 2-1 Applicable 303(d) List Impairments and TMDLs**

Receiving Water	Water Quality Impairment	
	303(d) list <sup>1</sup>	TMDL (2022 CGP Table H-1)
FMFCD Basin “R”	None	None
Teague Canal	None	None

<sup>1</sup> (State Water Resources Control Board (2), 2022)

Additional compliance actions applicable to the project are discussed in more detail in Section 7.7.

#### **2.1.4 Geology and Groundwater**

According to the USDA’s Web Soils Survey, the site is underlain by sandy loam with an additional layer of clay or cemented material further below. The depth of the clayey or cemented material depends on the location at the site. The parking area to the northeast is underlain by sandy loam up to 15 inches, clay further down to 21 inches, and cemented material at 21 to 37 inches. However, the majority of the site (97%) is underlain by sandy loam that is well drained (U.S. Division of Agriculture, 2024).

A geotechnical study was conducted for this site and observed the soil texture from bore samples along the west and east perimeter of the Site. The bore samples showed that the top layer consists of mainly clayey sand down to 10 inches, then varies from sandy silt to clayey sand (AhTye & Mason, 2024)

According to a groundwater monitoring well approximately 1.75 miles to the southwest (Site Code: 368728N1197630W001) with most recent measurements from April 19, 2024, groundwater occurs beneath the site at approximately 154.40 feet below ground surface. The groundwater gradient is toward the southwest (California Department of Water Resources, 2024).

#### **2.1.5 Project Description**

Project grading will occur on approximately 7.29 acres of the project, which comprises approximately 84% percent of the total area. The limits of grading are shown on Site Maps Figure 3 in Appendix A. Grading will include minor grading and fill activities, with the total graded material estimated to be roughly 11,590 cubic yards. Fill material is not expected to be imported. Roughly 1,850 cubic yards of graded materials are expected to be hauled away. Soil will be stockpiled in the staging area located in the north area of the site as shown on Site Maps Figure 3 in Appendix A. Construction activities will be phased and will include vegetation removal, demolition, grading, utility installation, paving, vertical construction, and landscaping. Figure 3 shows the areas of demolition and grading, including minor grading and fill activities. Figure 4 shows the areas of utility installation, paving, vertical construction, and landscaping.

**Table 2-2 Construction Site Estimates**

	<b>Acres</b>	<b>Percent of Site</b>
Total Construction site area	8.65	100%
Area of disturbance	8.51	98%
Area of grading	7.29	84%

**2.1.6 Developed Condition**

Post-construction surface drainage will be directed to storm drains through the site as surface flow and/or channelized flow.

The track and field stadium consists of pervious turf and landscaped areas and impervious concrete, rubber track, and sand areas. Surface drainage is conveyed as sheet flow throughout the turf grass field and rubber tracks where drainage is then directed into gutters. The track gutters convey flows as channelized flow for relatively short distances to storm drains. The storm drains discharge surface drainage to the newly constructed underground stormwater drainage system where it connects to a pre-existing pipe to the west. This pipe is owned by the Fresno Metropolitan Flood Control District (FMFCD) and is a component of the FMFCD MS4.

The complex's entrance area and the northern portion of the track direct surface drainage to trench drains that convey flows to the new underground stormwater drainage system. The system then conveys flows to the FMFCD MS4.

The redeveloped parking area at the northeast portion of the site will direct surface drainage as sheet flow towards existing, or newly constructed, curb and gutter, which will convey water as channelized flow to existing storm drains. The existing storm drains are interconnected and siphon water to the east gutter of the Clovis Community Campus road (adjacent to the Project). The gutter conveys stormwater as channelized flow towards Behymer Ave. to the south, and towards FMFCD storm drains on the north side of Behymer Ave. These drains are southeast of the site. The FMFCD storm drains convey flows to the FMFCD MS4.

The FMFCD MS4 will convey all discharges from the Project to a nearby stormwater retention basin, Basin "R", to the southwest at the northeast corner of Chestnut and Shepherd Avenues.

Post-construction drainage patterns and conveyance systems are presented on Site Maps Figures 4 and 4.i in Appendix A.

The changes of impervious areas/drainage patterns resulting from the Project and demonstration of the Project complying with the post-construction requirements of the local MS4 are presented in Appendix L

**2.2 PERMITS AND GOVERNING DOCUMENTS**

In addition to the 2022 CGP, the following documents have been taken into account while preparing this SWPPP:

- Regional Water Board requirements
- Basin Plan requirements

- Contract Documents
- Air Quality regulations and permits
- State Water Board GeoTracker database (GeoTracker)
- Federal Endangered Species Act – Not applicable.
- National Historic Preservation Act/Requirements of the State Historic Preservation Office – Not applicable.
- State of California Endangered Species Act – Not applicable.
- Clean Water Act Section 401 Water Quality Certifications and 404 Permits – Not applicable.
- CA Department of Fish and Game 1600 Streambed Alteration Agreement – Not applicable.
- California Ocean Plan – Not applicable.

### **2.3 STORMWATER RUN-ON FROM OFFSITE AREAS**

Run-on to the Site occurs as non-point discharges generated by: (1) the existing road and (2) the parking lot to the northeast of the Project site. Run-on occurs as channelized flow through existing curb and gutter from both contributing drainage areas and run-on is expected to occur throughout the lifetime of the site. The contributing areas comprise of asphalt roadway, asphalt parking lot, and associated landscaped areas. The non-point discharges expected to run-on to the Site include stormwater and irrigation flows.

The stormwater runoff drainage area contributing to offsite run-on is estimated to be approximately: (1) 20,038 sf and (2) 59,677 sf. The anticipated runoff coefficients range from 0.7-0.9. The anticipated off-site run-on to the project site from a 1" storm is estimated to be: 1,669 cu. ft. and (2) 4,973 cu. ft.

The 2022 CGP requires that temporary BMPs be implemented to direct offsite run-on away from disturbed areas using run-on controls. Since the source of run-on in both locations is from an existing road, curb, and gutter, diverting this run-on is not feasible. Instead, the following BMPs will be implemented: Scheduling BMPs to schedule road work during dry weather, and Gravel Bag Berms to reduce run-on velocity and sediment load. The Gravel Bag Berms will be located in the gutters where run-on is expected to occur. The off-site drainage areas and associated stormwater conveyance facilities or BMPs are shown on Site Maps, Figure 4.i in Appendix A.

### **2.4 FINDINGS OF THE CONSTRUCTION SITE SEDIMENT AND RECEIVING WATER RISK DETERMINATION**

A construction site risk assessment has been performed for the project and the resultant risk level is Risk Level 1. The factors used to calculate risk level were determined by the use of the standard methods in the CGP.

- The R-value was determined from EPA's *Rainfall Erosivity Factor Calculator for Small Construction Sites* at: <https://lew.epa.gov/> in accordance with the State Water Board Guidance for multi-year projects at: [https://www.waterboards.ca.gov/water\\_issues/programs/stormwater/smarts/construction/docs/rfactor\\_guide.pdf](https://www.waterboards.ca.gov/water_issues/programs/stormwater/smarts/construction/docs/rfactor_guide.pdf),
- K and LS factors used were provided by SMARTS for the Project region.

The risk level is based on project duration, location, proximity to impaired receiving waters, and soil conditions. A copy of the Risk Level determination submitted on SMARTS with the PRDs is included in Appendix B.

Table 2-3 and Table 2-4 summarize the sediment and receiving water risk factors and document the sources of information used to derive the factors.

**Table 2-3 Summary of Sediment Risk**

<b>RUSLE Factor</b>	<b>Value</b>	<b>Method for Establishing Value</b>
R	40.51	EPA's <i>Rainfall Erosivity Factor Calculator for Small Construction Sites</i>
K	0.32	SWRCB K-Factor Map, Generated by SMARTS
LS	0.19	SWRCB LS-Factor Map, Generated by SMARTS
<b>Total Predicted Sediment Loss (tons/acre)</b>		<b>2.46</b>
<b>Overall Sediment Risk</b> Low Sediment Risk < 15 tons/ acre Medium Sediment Risk >= 15 and < 75 tons/acre High Sediment Risk >= 75 tons/acre		<input checked="" type="checkbox"/> <b>Low</b> <input type="checkbox"/> <b>Medium</b> <input type="checkbox"/> <b>High</b>

The project site discharges into FMFCD Basin “R” which may discharge into the Teague Canal.

**Table 2-4 Summary of Receiving Water Risk**

<b>Receiving Water Name</b>	<b>303(d) Listed for Sediment Related Pollutant <sup>(1)</sup></b>	<b>TMDL for Sediment Related Pollutant <sup>(1)</sup></b>	<b>Beneficial Uses of COLD, SPAWN, and MIGRATORY <sup>(1)</sup></b>
FMFCD Basin “R”	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Teague Canal	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>Overall Receiving Water Risk</b>			<input checked="" type="checkbox"/> <b>Low</b> <input type="checkbox"/> <b>High</b>
(1) If yes is selected for any option the Receiving Water Risk is High			

Risk Level 1 sites are subject to the narrative effluent limitations specified in the 2022 CGP, and may be subject to numeric effluent limits for applicable TMDLs, dewatering activities, active treatment systems and passive treatment systems used on site. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in stormwater and authorized non-stormwater through the use of controls, structures, and best management practices (BMPs). This SWPPP has been prepared to address Risk Level 1 requirements (2022 CGP Attachment D). Projects that discharge to a water body and or watershed listed in Table H-2 are subject to both the narrative and numeric effluent limitations imposed by the TMDL requirements in Attachment H. There are no water bodies with TMDLs in the Central Valley Regional Water Quality Control Board region (the region of the Project), therefore the Project is not subject to any TMDL requirements.

**Table 2-7 TMDL Numeric Action Levels, Numeric Effluent Limits**

<b>TMDL</b>	<b>Parameter</b>	<b>Unit</b>	<b>Numeric Action Level</b>	<b>Numeric Effluent Limit</b>
None	NA	NA	NA	NA

## **2.5 CONSTRUCTION SCHEDULE**

The site sediment risk was determined based on construction taking place between:

**Estimate Project Start Date:** 01/14/2025

**Estimate Project End Date:** 05/06/2026

Modification or extension of the schedule (start and end dates) may affect risk determination and permit requirements. The LRP shall contact the QSD if the schedule changes during construction to address potential impact to the SWPPP. The estimated schedule for planned work can be found in Appendix E.

Significant land disturbing activities include minor grading throughout the site and the road work in the adjacent roadway to the east. There are no existing water bodies or drainages on the majority of the site. However, demolition of existing curb and gutter will impact the existing drainage from the south end of the Clovis Community College campus to Behymer Avenue further south. As discussed in Section 2.3, Scheduling BMPs will be implemented to avoid road work during the wet weather season.

## **2.6 POTENTIAL CONSTRUCTION ACTIVITY AND POLLUTANT SOURCES**

Appendix F includes a list of construction activities and associated materials that are anticipated to be used onsite as well as the pollutant source assessment form that was completed for the project. These activities and associated materials will or could potentially contribute pollutants, other than sediment, to stormwater runoff.

The anticipated activities and associated pollutants were used in Section 3 to select the BMPs for the project. Locations of anticipated pollutants and associated BMPs are shown on the Site Map in Appendix A.

Additionally, proper measures will be taken to ensure that trench spoils or any other soils disturbed during construction activities that are contaminated are not discharged with stormwater or non-stormwater discharges into storm drains or water bodies (except pursuant to a separate NPDES Permit). If contaminated soils are found on site, and the responsible party cannot be identified or fails to take action, soils will be sampled to determine proper handling and protect public safety. The appropriate local, State, and federal agencies along with the appropriate Regional Water Board will be notified when contaminated soils are observed.

For sampling requirements for non-visible pollutants associated with construction activity, please refer to Section 7.7.1. For a full and complete list of onsite pollutants, refer to the Safety Data Sheets (SDS), which are retained onsite at the construction trailer or are available electronically at the site.



## 2.7 TMDL REQUIREMENTS

Based on the project's receiving water and the pollutant source assessment, there are no applicable TMDLs for the Project.

**Table 2-8 Project TMDLs**

<b>TMDL</b>	<b>Applicable Water Body/ Watershed</b>	<b>Pollutants</b>	<b>Additional TMDL- Related NAL or NEL</b>	<b>Compliance Actions</b>
None	NA	NA	NA	NA

## 2.8 IDENTIFICATION OF NON-STORMWATER DISCHARGES

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the 2022 CGP and listed in the SWPPP, or authorized under a separate NPDES permit, are prohibited.

Non-stormwater discharges that are authorized from this project site include the following:

- De-chlorinated potable water sources and non-potable water sources such as:
  - fire-fighting activity,
  - fire hydrant system flushing,
  - irrigation of vegetative erosion control measures,
  - uncontaminated water line flushing,
  - pipe flushing and testing,
  - air conditioning and compressor condensate,
  - water to control dust, uncontaminated groundwater or spring water from construction dewatering activities in compliance with Attachment J of the 2022 CGP
- Non-stormwater discharges that meet the following conditions:
  - The discharge is not routed through site areas with exposed soil, except for water used for dust control or to vegetation irrigation to stabilize areas;
  - The discharge does not cause or contribute to an exceedance of water quality standards in the receiving water;
  - The discharge complies with other applicable requirements of the 2022 CGP including applicable action levels, effluent limitations, and monitoring and reporting requirements;
  - The discharge is not prohibited by an applicable regional or statewide water quality control plan;
  - The discharge is in accordance with other applicable State and Regional Water Board permits; and

These authorized non-stormwater discharges will be managed with the stormwater and non-stormwater BMPs described in Section 3 of this SWPPP and will be minimized under the direction of the QSP. Additionally, the non-stormwater discharges not applicable to this project are still allowable granted they do not contact potential pollutant sources.

Activities at this site that may result in unauthorized non-stormwater discharges include:

- Debris and trash

- In accordance with State Water Board Resolution 2015-0019, the Trash Provisions of the Water Quality Control Plan for Ocean Waters of California and the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California, as applicable to construction stormwater discharges;
- Wastewater from washout or cleanout of areas, structures or equipment with concrete, grout, stucco, paint, or other construction materials;
- Form-release oils and curing compounds;
- Fuels, oils, fluids, or other materials used in vehicle and equipment operation and maintenance;
- Soaps, solvents, or detergents (e.g., used in vehicle equipment washing or external building wash down); and
- Toxic or hazardous substances (e.g., asbestos, lead, mercury, or PCBs).

Steps will be taken, including the implementation of appropriate BMPs, to ensure that unauthorized discharges are eliminated, controlled, disposed, or treated on-site.

Discharges of construction materials and wastes, such as fuel or paint, resulting from dumping, spills, or direct contact with rainwater or stormwater runoff, are also prohibited.

## 2.9 REQUIRED SITE MAP INFORMATION

The construction project's Site Map(s) showing the project location, surface water boundaries, geographic features, construction site perimeter and general topography, locations of storm drain inlets that receive runoff from the project, and other requirements identified in 2022 CGP Sections IV.O.2. k. and l are located in Appendix A. Table 2-9 identifies Maps or Sheet Nos. where required elements are illustrated.

**Table 2-9 Required Map Information**

Included on Map/Plan Sheet No. <sup>(1)</sup>	Required Element
<b>Pre-Earthwork Drawings</b>	
All Figures	Site and project boundaries
Figure 2	Areas disturbed during geotechnical or other preconstruction investigation work
Figure 2	Existing roads and trails
Figure 2	Drainage areas
Figure 2	Discharge locations
Figure 2	Existing storm drain system if applicable
Figure 2	Proposed locations of storage areas for waste
Figure 2	Proposed locations of construction materials
Figure 2	Proposed locations of project staging areas
Figure 2	Proposed locations of stockpiles
Figure 2	Proposed locations of vehicles, equipment staging and vehicle maintenance

**Table 2-9 Required Map Information**

<b>Included on Map/Plan Sheet No. <sup>(1)</sup></b>	<b>Required Element</b>
Figure 2	Proposed locations of loading/unloading materials
Figure 2	Proposed locations of site access (entrance/exits)
Figure 2	Proposed locations of fueling, water storage, water transfer for dust control
Figure 3	Proposed locations of demolition
Figure 2	Proposed locations of other construction support activities
<b>Construction and Earthwork Drawing(s)</b>	
Figures 3 and 4	Site layout (grading plans) including roads
Figures 3 and 4	Site and project boundaries
Figures 3 and 4.i	Drainage areas
Figures 3 and 4.i	Discharge locations
Figures 3 and 4.i	Sampling locations
Figures 3 and 4	Areas of soil disturbance (temporary or permanent)
Figures 3 and 4	Proposed active areas of soil disturbance (cut or fill)
Figures 3 and 4	Proposed locations of erosion control BMPs
Figures 3 and 4	Proposed locations of sediment control BMPs
Figures 3 and 4	Proposed locations of run-off BMPs
✓/NA	Temporary and/or permanent run-on conveyance (if applicable)
NA	Proposed locations of active treatment systems(s) (if applicable)
Figures 3 and 4	Proposed locations of storage areas for waste
Figures 3 and 4	Proposed locations of construction materials
Figures 3 and 4	Proposed locations of project staging areas
Figures 3 and 4	Proposed locations of stockpiles
Figures 3 and 4	Proposed locations of vehicles, equipment and vehicle maintenance
Figures 3 and 4	Proposed locations of loading/unloading materials
Figures 3 and 4	Proposed locations of site access (entrance/exits)
Figures 3 and 4	Proposed locations of fueling, water storage, water transfer for dust control
Figures 3 and 4	Proposed locations of demolition
Figures 3 and 4	Proposed locations of other construction support activities
Figures 3 and 4	Site-specific procedures to implement final stabilization BMPs as soon as reasonably practicable

Notes: (1) Indicate maps or drawings that information is included on (e.g., Vicinity Map, Site Map, Drainage Plans, Grading Plans, Progress Maps.)

## Section 3 Best Management Practices

### 3.1 SCHEDULE FOR BMP IMPLEMENTATION

BMPs will be implemented as per the schedule indicated in Table 3-1.

**Table 3-1 BMP Implementation Schedule**

	<b>BMP</b>	<b>Location</b>	<b>Implementation</b>	<b>Duration</b>
<b>Erosion Control BMPs</b>	EC-1, Scheduling	Entire Site	From pre-construction until final stabilization.	Entirety of Project
	EC-2, Preservation of Existing Vegetation	Areas not planned for disturbance, or that can be planned to be disturbed later to minimize disturbed soil areas.	Start of Construction of Project and prior to each disturbance of a new area.	Entirety of Project
	EC-3, Hydraulic Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-4, Hydroseed	Areas not planned for disturbance for the next 14 days, areas for final stabilization.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-3 days of initial spraying and re-applied as needed.
	EC-5, Soil Binders	Areas not planned for disturbance for the next 14 days, inactive high dust generating areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-6, Straw Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial installation and re-applied as needed.
	EC-7, Geotextiles and Mats	Steep disturbed slopes, under trackout rocks, in disturbed stormwater conveyance channels.	Pre-earthwork (trackout installation), after completing grading of an area, pre-storm events, final stabilization.	As needed during on-going construction activities.
	EC-8, Wood Mulching	Areas planned for landscaping.	Final stabilization phase.	1-2 weeks.
	EC-9, Earth Dikes and Drainage Swales	At border of run-on areas or for anticipated disturbed flow concentration channels.	Prior to or early in grading phase to divert run-on. Ongoing based on QSPs during- and post-storm observations.	1-2 weeks of installation and ongoing maintenance.
	EC-10, Velocity Dissipation Devices	Designed stormwater outfalls/conveyance channels and observed temporary concentrated flow areas.	After completing construction of a new stormwater outfall. After disturbance of an existing concentrated flow channel or creation of a new channel.	1 week to install. Ongoing maintenance to remove accumulated sediment, trash, litter, etc.

**Table 3-1 BMP Implementation Schedule**

	<b>BMP</b>	<b>Location</b>	<b>Implementation</b>	<b>Duration</b>
	<del>EC-11, Slope Drains</del>	<del>Designed slope drains.</del>	<del>After completing construction of a new drain and outfall.</del>	<del>1-3 weeks.</del>
	<del>EC-12, Streambank Stabilization</del>	<del>Stream banks, with applicable permits from USACE, SWRCB, and CDFW.</del>	<del>Prior to disturbing large upland areas that will increase stormwater discharge volume to stream.</del>	<del>1-2 weeks. Ongoing maintenance.</del>
	EC-14, Compost Blanket	Areas not planned for disturbance for the next 14 days, final stabilization areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-3 weeks.
	EC-15, Soil Preparation-Roughening	Areas not planned for disturbance for the next 14 days, final stabilization areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-5 days for roughening. 1-2 weeks for soil amendments.
	EC-16, Non-Vegetative Stabilization	Areas requiring immediate stabilization, areas expected to be constantly disturbed (e.g. staging area, access routes), planned landscaping areas.	When disturbed soil areas require immediate stabilization (e.g. eroding slopes), when setting up staging area, final stabilization phase.	1 week. Ongoing maintenance.
<b>Sediment Control BMPs</b>	SE-1, Silt Fence	Flat areas below disturbed slopes. Site perimeter.	Prior to disturbing slopes. Prior to commencing grading (perimeter control).	1-2 weeks. Ongoing maintenance.
	<del>SE-2, Sediment Basin</del>	<del>At designed sediment basin location for Project.</del>	<del>Prior to mass grading.</del>	<del>1-3 months. Ongoing maintenance.</del>
	SE-3, Sediment Trap	Flat low areas receiving concentrated stormwater, especially prior to outfalls.	At start of grading.	1-5 days. Ongoing maintenance.
	SE-4, Check Dams	Concentrated flow channels.	Prior to upgrade land disturbance that discharges to flow channel. Immediately after disturbing flow channel.	1-2 days. Ongoing maintenance.
	SE-5, Fiber Rolls	Site/disturbed area perimeters, disturbed slope contours, around soil stockpiles.	Prior to grading of an area. Immediately after disturbing slopes. As needed around stockpiles.	1-2 weeks. Ongoing maintenance.
	SE-6, Gravel Bag Berm	Site/disturbed area perimeters, flat areas below disturbed slopes.	During Construction	1-2 days. Ongoing maintenance.
	SE-7, Street Sweeping	Internal paved site areas, off-site paved areas (site exists)	During Construction	Up-to twice per day, as needed.
	SE-8, Sandbag Barrier	Flat areas below disturbed slopes, along disturbed slope contours, stormwater diversion areas.	During Construction	1-2 days. Ongoing maintenance.

**Table 3-1 BMP Implementation Schedule**

	<b>BMP</b>	<b>Location</b>	<b>Implementation</b>	<b>Duration</b>
	<del>SE-9, Straw Bale Barrier</del>	<del>Flat areas below disturbed slopes. Site perimeter.</del>	<del>Prior to disturbing slopes. Prior to commencing grading (perimeter control).</del>	<del>1-2 weeks. Ongoing maintenance.</del>
	SE-10, Storm Drain Inlet Protection	Existing and new drain inlets	Prior to grading, immediately after installation of new drain inlets.	1-2 days. Frequent ongoing maintenance.
	<del>SE-11, Active Treatment Systems</del>	<del>Per ATS plan.</del>	<del>Per ATS plan.</del>	<del>Per ATS plan.</del>
	SE-12, Manufactured Linear Sediment Controls	Paved site perimeters, disturbed site perimeters, in flow channels as check structure, at flat areas below disturbed slopes.	Prior to grading and ongoing as needed.	1-2 weeks. Ongoing maintenance.
	SE-13, Compost Sock and Berm	Site/disturbed area perimeters, disturbed slope contours, drain inlets.	Prior to grading of an area. Immediately after disturbing slopes.	1-2 weeks. Ongoing maintenance.
	<del>SE-14, Biofilter Bags</del>	<del>Areas needing immediate sediment control BMPs, including: perimeter controls, DI protections, and as a check dam.</del>	<del>During Construction</del>	<del>1 day. Ongoing maintenance and replacement.</del>
<b>Wind Erosion Control BMPs</b>	WE-1, Wind Erosion Control	Disturbed site areas.	Every non-wet day of active construction.	2-4 times per day.
	EC-3, Hydraulic Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-4, Hydroseed	Areas not planned for disturbance for the next 14 days, areas for final stabilization.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-3 days of initial spraying and re-applied as needed.
	EC-5, Soil Binders	Areas not planned for disturbance for the next 14 days, inactive high dust generating areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-6, Straw Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial installation and re-applied as needed.
	EC-15, Soil Preparation-Roughening (roughening only)	Areas not planned for disturbance for the next 14 days, final stabilization areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-5 days for roughening.

**Table 3-1 BMP Implementation Schedule**

	<b>BMP</b>	<b>Location</b>	<b>Implementation</b>	<b>Duration</b>
<b>Tracking Control BMPs</b>	EC-16, Non-Vegetative Stabilization	Areas requiring immediate stabilization, areas expected to be constantly disturbed (e.g. staging area, access routes), planned landscaping areas.	When frequently disturbed soil areas (e.g. staging area) is contributing to significant dust generation.	1 week. Ongoing maintenance.
	TC-1, Stabilized Construction Entrance and Exit	Site exits/entrances approved by landowner and relevant city, county, or Caltrans.	Start of Construction, prior to grading.	1 week. Ongoing maintenance. May be relocated for new phases.
	TC-2, Stabilized Construction Roadway	Site exits/entrances approved by QSD, landowner, and relevant city, county, or Caltrans.	Start of Construction, prior to grading.	2-3 weeks. Ongoing sweeping.
	<del>TC-3, Entrance/Outlet Tire Wash</del>	<del>Inside site adjacent to exits/entrances.</del>	<del>Start of Construction, prior to grading. As needed to supplement TC-1.</del>	<del>2-3 weeks. Ongoing maintenance.</del>
<b>Non-Stormwater Control BMPs</b>	NS-1, Water Conservation Practices	All potable/non-potable water sources, and water holding equipment, valves, and hoses.	During Construction	Ongoing.
	NS-2, Dewatering Operation	Site locations impacted by pooled stormwater and non-stormwater.	After rain events or other non-stormwater accumulation.	1 day of de-watering per de-watering event.
	NS-3, Paving and Grinding Operation	Areas designated or paving/grinding and paving/grinding equipment, material, and waste storage locations.	During paving/grinding operations.	From start of paving equipment arriving on-site until paving equipment has left site. During grinding operations and waste management.
	<del>NS-4, Temporary Stream Crossing</del>	<del>Designated crossing locations, with applicable permits from USACE, SWRCB, and CDFW.</del>	<del>Prior to stream crossing</del>	<del>1-3 weeks.</del>
	<del>NS-5, Clear Water Diversion</del>	<del>Work areas in water bodies.</del>	<del>Prior to construction in water bodies</del>	<del>1-4 weeks. Ongoing maintenance.</del>
	NS-6, Illicit Connection-Illegal Discharge Connection	Entire site.	During Construction	Ongoing.



**Table 3-1 BMP Implementation Schedule**

	<b>BMP</b>	<b>Location</b>	<b>Implementation</b>	<b>Duration</b>
	NS-7, Potable Water Irrigation Discharge Detection	All potable/non-potable water sources and equipment.	During Construction	Immediately after installing irrigation system. Ongoing.
	NS-8, Vehicle and Equipment Cleaning	Designated and designed vehicle/equipment washing location.	Prior to any on-site vehicle and equipment washing.	1-2 weeks to construct. Ongoing when washing.
	NS-9, Vehicle and Equipment Fueling	Designated fueling location.	Prior to any on-site fuel tank arriving on-site.	1 day to install. Ongoing when fueling.
	NS-10, Vehicle and Equipment Maintenance	Designated vehicle and equipment maintenance location.	Prior to any on-site vehicle and equipment maintenance.	1 day to install. Ongoing when fueling.
	<del>NS-11, Pile Driving Operations</del>	<del>Pile driving and equipment storage locations</del>	<del>Prior to pile driving equipment arriving on-site</del>	<del>1 day to install. Ongoing.</del>
	NS-12, Concrete Curing	Concrete curing compound use and storage location.	Prior to concrete curing compound arriving on-site, during use, and ongoing while storing compound on-site.	1 day to install. Ongoing.
	NS-13, Concrete Finishing	Planned concrete finishing locations.	Prior to starting concrete finishing, during use, and while material is stored on-site	1 day to install. Ongoing.
	<del>NS-14, Material Over Water</del>	<del>Planned work areas over water, with applicable permits from USACE, SWRCB, and CDFW.</del>	<del>Prior to work over water and during.</del>	<del>Ongoing.</del>
	<del>NS-15, Demolition Adjacent to Water</del>	<del>Planned demolition areas adjacent to water</del>	<del>Prior to start of demolition and during.</del>	<del>1-5 days to install. Ongoing</del>
	<del>NS-16, Temporary Batch Plants</del>	<del>Designated temporary batch plant location.</del>	<del>At start of construction of temporary batch plant and ongoing during operation and storage.</del>	<del>Planning prior to batch plant construction and ongoing until all materials are removed from site.</del>
<b>Constructi on Material</b>	WM-1, Material Delivery and Storage	Designated delivery and storage location.	Prior to material delivery, during delivery, and ongoing for storage.	Entirety of project
	WM-2, Material Use	Planned locations for each unique material use.	Prior to and during material use.	Entirety of project

**Table 3-1 BMP Implementation Schedule**

	<b>BMP</b>	<b>Location</b>	<b>Implementation</b>	<b>Duration</b>
<b>Waste Management Control BMPs</b>	WM-3, Stockpile Management	Designated stockpile location and on-site soil source location.	Immediately after stockpiling materials. Prior to rain and wind events.	Entirety of project
	WM-4, Spill Prevention and Control	Entire site.	Initial spill training and ongoing.	Entirety of project
	WM-5, Solid Waste Management	Designated solid waste storage locations and solid waste generating areas/activities.	Prior to generation of solid waste and during all of construction	Entirety of project
	WM-6, Hazardous Waste Management	Designated hazardous waste storage locations and hazardous waste generating areas/activities.	Prior to construction activities and during all of construction	Entirety of project
	<del>WM-7, Contaminated Soil Management</del>	<del>Identified contaminated soil locations.</del>	<del>Prior to disturbance of contaminated soil areas and ongoing until disposal of hazard soil and final stabilization of hazard soil location.</del>	<del>Ongoing until all hazard soil is removed from site or stabilized.</del>
	WM-8, Concrete Waste Management	Planned concrete, stucco, cement, and mortar use and storage locations, including wastes.	Prior to concrete, stucco, cement, and mortar use. Ongoing while storing dry materials and wastes.	Ongoing when concrete, stucco, cement, mortar, and resulting wastes are on-site.
	WM-9, Sanitary-Septic Waste Management	Designated portable outhouse storage locations.	All of construction with weekly maintenance.	Entirety of project
	WM-10, Liquid Waste Management	Designated liquid waste storage locations and liquid waste generating areas/activities.	Prior to generation of liquid waste and while liquid waste is stored/being generated on-site.	Ongoing with liquid waste stored on-site.

Erosion and sediment controls are required by the 2022 CGP to provide effective reduction or elimination of sediment related pollutants in stormwater discharges and authorized non-stormwater discharges from the Site. Applicable BMPs are identified in this section for erosion control, sediment control, tracking control, and wind erosion control.

### **3.2.1 Erosion Control**

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles.

This construction project will implement the following practices to provide effective temporary and final erosion control during construction:

1. Preserve existing vegetation where required and when feasible.

2. The area of soil disturbing operations shall be controlled such that the Contractor is able to implement erosion control BMPs quickly and effectively.
3. Stabilize non-active areas within 14 days of cessation of construction activities or sooner if stipulated by local requirements.
4. Control erosion in concentrated flow paths by applying erosion control blankets, check dams, erosion control seeding, or alternate methods.
5. Prior to the completion of construction, apply permanent erosion control to remaining disturbed soil areas.

Sufficient erosion control materials shall be maintained onsite to allow implementation in conformance with this SWPPP.

The following erosion control BMP selection table, Table 3-2 indicates the BMPs that will be implemented to control erosion on the construction site. Fact Sheets for temporary erosion control BMPs are provided in Appendix G.

These temporary erosion control BMPs shall be implemented in conformance with the following guidelines and as outlined in the BMP Factsheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

**Table 3-2 Erosion Control BMPs**

CASQA Fact Sheet	BMP Name	Considered for the Project <sup>(1)</sup>	BMP Used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
EC-1	Scheduling	✓	✓		
EC-2	Preservation of Existing Vegetation	✓	✓		
EC-3	Hydraulic Mulch	✓ <sup>(2)</sup>	✓		
EC-4	Hydroseed	✓ <sup>(2)</sup>	✓		
EC-5	Soil Binders	✓ <sup>(2)</sup>	✓		
EC-6	Straw Mulch	✓ <sup>(2)</sup>	✓		
EC-7	Geotextiles and Mats	✓ <sup>(2)</sup>	✓		
EC-8	Wood Mulching	✓ <sup>(2)</sup>	✓		
EC-9	Earth Dike and Drainage Swales	✓ <sup>(3)</sup>	✓		
EC-10	Velocity Dissipation Devices	✓ <sup>(3)</sup>	✓		
EC-11	Slope Drains	✓ <sup>(3)</sup>		✓	There are no outfalls to slopes that require BMP.
EC-12	Stream Bank Stabilization	✓		✓	Project does not drain to stream.
EC-14	Compost Blankets	✓ <sup>(2)</sup>		✓	Not necessary for Project with mild slopes.
EC-15	Soil Preparation-Roughening	✓	✓		
EC-16	Non-Vegetated Stabilization	✓ <sup>(2)</sup>	✓		
WE-1	Wind Erosion Control	✓	✓		
<sup>(1)</sup> The 2022 CGP Fact Sheet Section I.R.1.d.through I.R.1.i.describes various BMPs that should be considered for use on the construction site. <sup>(2)</sup> The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements. <sup>(3)</sup> All run-on and runoff from the construction site shall be managed for Risk Level 2 and 3 and Risk Level 1 if the evaluation of quantity and quality of run-on and runoff deems them necessary or visual inspections show that the site requires these controls. Run-on from offsite shall be directed away from all disturbed areas, diversion of offsite flows may require design/analysis by a licensed civil engineer and/or additional environmental permitting.					

## **EC-1 Scheduling**

Scheduling is a critical BMP for every Project. The contractor shall continually reevaluate and adjust the Project construction schedule by considering current and expected site conditions, the upcoming forecast, and reasonably predictable long-term weather events.

- On a macro-level, scheduling to start a Project or mass grading in months with less rainfall amounts takes no products or labor to significantly reduce would-be periods of high erosion on a Project site. The contractor shall consider the average monthly rainfall of the Project location to decide when to start mass grading for the Project. If the Contractor decides to have large areas of disturbed soil during high-rain fall periods, the Contractor shall utilize effective erosion and sediment controls to offset the higher erosion risk at the site.
- On a micro-level, scheduling additional land disturbance or use of polluting materials (asphalt concrete, concrete, stucco, painting, herbicide, fertilizer, etc.) when there is a forecast of no rain for a long period allows the contractor has time to complete the work of the Project and have time to install necessary BMPs and for polluting materials to cure, dry, stabilize, etc.. The contractor shall check the local NOAA forecast prior to disturbance of new soil areas and use of stormwater polluting materials that require time cure, dry, stabilize, etc.
- The contractor shall suspend non-emergency construction work during periods of extreme wind events over 40 MPH.
- The contractor shall minimize construction work at the job site during forecasted qualifying precipitation events as defined in the CGP and Section 7.3 of this SWPPP.

Road work in adjacent roadway to the east will expose soil that is prone to soil erosion and may contaminate stormwater run-on from upstream contributing drainage areas. If feasible, conduct roadwork during the dry season to avoid stormwater contamination.

## **EC-2 Preservation of Existing Vegetation**

The Contractor shall reduce the discharge of pollutants from the site by conserving as much of the existing vegetation as possible. If possible, vegetative buffer strips will be left adjacent to watercourses, impervious areas, drain inlets, and along the site perimeter. The purpose of minimizing the removal or injury of existing trees, vines, shrubs and grasses is that they naturally protect soil from erosion.

## **EC-3 Hydraulic Mulch**

- The Contractor shall consider the application of hydraulic mulch to provide sediment control and temporary soil stabilization, or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 4. Hydraulic mulch may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f).
  - On soil stockpiles

### **Suitable Applications**

- Hydraulic Mulch is a medium-durability erosion control BMP intended for temporarily stabilizing disturbed soil areas. This BMP typically includes a soil binder similar to EC-5, but also includes mulch material (typically wood fiber) to provide soil cover in addition to binding soil particles.
- Hydraulic mulch shall be considered to be installed to flat to mild slopes of disturbed soil areas not expected to receive vehicle traffic.
- Hydraulic mulch can typically be expected to be re-installed once over a rainy season.
- Hydraulic mulch be more effective (especially on slopes) when paired with EC-15 Soil Roughening and preparation (specifically track walking or soil scarification) or SE-4 Fiber rolls on slopes.
- Hydraulic mulch is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil

Preparation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

#### Implementation

- Apply according to manufacturer recommendation.
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking up and down the slopes.
- To be effective, hydraulic matrices require 24 hours to dry before rainfall occurs.
- May require a second application in order to remain effective for an entire rainy season.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Paper based hydraulic mulches alone shall not be used for erosion control.

#### **EC-4 Hydroseed**

Hydroseeding is an erosion control that typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily or permanently protect exposed soils from erosion by water and wind.

Apply to areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

- The Contractor shall consider the application of hydroseed to provide sediment control and temporary (or permanent) soil stabilization, or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 4. Hydroseed may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
  - On soil stockpiles

To select the appropriate matrix, an evaluation of site conditions shall be performed with respect to:

- Soil conditions; maintenance requirements; site topography; sensitive adjacent areas; season and climate; water availability; seed mix; and plans for permanent vegetation.
- The Contractor shall hydroseed disturbed areas of the Project for final stabilization as specified in the Project Plans, Project hydroseeding specifications, and shown in Appendix A: Site Maps, Figure 4.
- The Contractor shall consider the use of hydroseed for temporary or permanent stabilization of areas of soil disturbed by the Project that do not have any improvements in the landscaping plans.
  - When using hydroseed, the Contractor and QSP shall consider the need to implement the additional BMPs of EC-7 Geotextile Mats, EC-Soil Preparation and roughening (for roughening and nutrient soil amendments), and SC-4 Fiber Rolls for steep slopes.
- If hydroseeding is not selected, disturbed soil areas shall achieve final stabilization by other methods including:
  - hand or drill seeding in conjunction with temporary soil cover of EC-6 Straw Mulch or EC-3 Hydraulic Mulch as needed to promote moisture needed for germination.
- Hydroseeding is one possible temporary erosion control BMP. Other temporary erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preparation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective

erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per CGP Appendix D Section II.D.f.

### Implementation

- Avoid use of hydro-seeding in areas that would be incompatible with future earthwork activities and would have to be removed.
- Hydro-seeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydro-seeding must be used in conjunction with mulching and sediment controls on disturbed slopes.
- Hydro-seeding can be accomplished using a multiple step or one step process. The multiple step process ensures maximum direct contact of the seeds to soil. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the area to be seeded with the furrows trending along the contours.
- Apply straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer may be liquid, pellet or granular form.
- Follow up applications should be made as needed to cover weak spots and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

### **EC-5 Soil Binders**

- The Contractor shall consider the application of soil binders to provide sediment control and temporary (or permanent) soil stabilization, or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 4. Soil binders may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
- Soil binder is a relatively cheap and effective BMP for erosion control that can be installed quickly by the Contractor with minimal specialty equipment. Soil binder is appropriate for disturbed soil areas that will not experience vehicle traffic.
- Different soil binders should be considered for use of water erosion control and wind erosion control.
- Soil binder is necessary when implementing EC-6 Straw mulch for sandy soil conditions.
- Soil binder shall not be applied when there is any forecasted rain for the next 24-hours to prevent the discharge of pollutants from the soil binder product.
- Soil binder shall be applied according to the manufacturer's specifications.
- The Contractor and QSP shall consult with CASQA EC-5 and Appendix B of the CASQA Handbook to select an appropriate soil binder for the specific use situation of the Project and submit the proposed product to the QSD prior to use. The QSD shall respond to the Contractor within three working days (not including the day of submittal) for approval of the proposed soil binder product.
- Soil Binders is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preparation

and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

#### **EC-6 Straw Mulch**

- The Contractor shall consider the application of straw mulch to provide sediment control and temporary (or permanent) soil stabilization, or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 4. Straw mulch may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
- Straw mulch shall be considered to be installed to flat to mild slopes of disturbed soil areas not expected to receive vehicle traffic.
- The Contractor shall consider the use of straw mulch in conjunction for areas of seeding or hydroseeding to promote the growth of vegetation by improving soil moisture after seeding.
- The contractor shall only use a weed-free agricultural straw product.
- When applying straw mulch on sandy soil, the contractor shall pair straw mulch application with a soil binder. The Contractor and QSP shall consult with CASQA EC-5 and Appendix B of the CASQA Handbook to select an appropriate soil binder for the specific use situation of the Project and submit the proposed product to the QSD prior to use. The QSD shall respond to the Contractor within three working days (not including the day of submittal) for approval of the proposed soil binder product.
- If straw mulch is applied alone with no tackifier/binder, the Contractor shall at a minimum track walk over applied straw to into the soil, or use a crimper or punch roller to fully work straw into the soil. The Contractor shall plan for reapplication of straw as needed and consider the cost-benefits of working applied straw mulch into soil.
- Straw Mulch is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preparation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

#### **EC-7 Geotextiles and Mats**

Geotextiles and mats come in a variety of materials and thicknesses for different use cases. The contractor shall different types of geotextiles for the following circumstances:

##### Polypropylene fabric

- Material should be a woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp); 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec<sup>-1</sup> in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355.
- Traditional black polypropylene fabric shall be used for:
  - Lining of disturbed concentrated flow channels.
    - Soil areas shall be prepared by clearing of trash, plant material, and rocks for a smooth surface. Fabric shall be dug into the soil at top of slope, and installed with full contact to the soil to prevent stormwater from flowing under an installed mat.



- Consider the addition of check dams per SE-4 to concentrated flow channels.
- A reusable stockpile cover (or achieved by use of plastic tarps).
- Underlining of trackout control rocks per TC-1.
- Underlining of landscaping mulch materials (woodchips, gravel, decomposed granite, rip rap, etc.) temporarily installed for soil stabilization as a tool for removal or re-use of landscaped materials for the final landscaping design.
- Immediate stabilization of disturbed slopes steeper than 3:1 (H:V) prior to rain events.
  - Disturbed slopes shall be prepared as a smooth surface by removing trash, plant material, and rocks.
  - Blanket shall be installed with overlap and staple spacing and type according to CASQA EC-7.

## **EC- 8 Wood Mulching**

- The Contractor shall consider the use of wood mulching as an erosion control BMP to provide effective soil cover of disturbed areas that are not planned for disturbance for the next 14 days. If Wood Mulching is not selected, the Contractor shall implement an equivalent erosion control BMP for these areas throughout the Project.
- The Contractor shall consider the procuring wood chips that are a part of the landscaping design early for use as a recyclable temporary erosion control BMP throughout the Project. Disturbed soil areas needing immediate stabilization can be covered with polypropylene geotextile mats to facilitate collection of woodchips from temporary areas for re-use for the final landscaping design.
- Wood Mulching shall be used for final stabilization areas, as specified in the Project landscaping plan.
- Wood mulching shall not be used for slopes steeper than 5:1 (H:V).
- Wood mulching is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-14 Compost Blankets, EC-15 Soil Preparation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per CGP Appendix D Section II.D.f.

## **EC-9 Earth Dike and Drainage Swales**

Earth dikes and drainage swales are erosion controls that consists of a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site and to divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another. Earth dikes and drainage swales may be used:

- To convey surface runoff down sloping land.
- To intercept and divert runoff to avoid sheet flow over sloped surfaces.
- To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel.
- To intercept runoff from paved surfaces.
- To prevent run-on to material and waste storage areas.
- Below steep grades where runoff begins to concentrate.
- Along roadways and facility improvements subject to flood drainage.
- At the top of slopes to divert run on from adjacent or undisturbed slopes.

- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows.
- Divert sediment laden runoff into sediment basins or traps.

When earthen dikes and/or drainage swales are used at the Project site, the Contractor shall:

- Newly graded slopes should be protected from erosion by runoff.
- Carefully size and locate earth dikes, drainage swales.
- Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
- Use a lined ditch for high flow velocities.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

### Earthen Dikes

The Contractor shall Review civil drawings for specifications and construct earth dikes according to the specifications in the approved plan. Generally temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either riprap or sod for slopes in excess of 5%. Plastic sheeting may be used to line the dike however it has a short useful life and may need to be replaced more frequently. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain. If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

<b>Channel Grade</b>	<b>Riprap Stabilization</b>
0.5%-1.0%	4 in Rock
1.1-2.0%	6 in Rock
2.1-4.0%	8 in Rock
4.1-5.0%	8 in – 12 in Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth or plastic sheeting may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

### Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual or approved civil drawings). Unless approved civil drawings or local drainage design criteria state otherwise, drainage swales should be designed as follows:

- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft.
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent and use riprap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing.
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

#### **EC-10 Velocity Dissipation Devices**

The Contractor shall reduce the discharge of pollutants from the site by construction and maintenance of velocity dissipation devices in disturbed concentrated stormwater conveyance channels and/or channels expected to convey turbid stormwater from disturbed areas. The purpose of velocity dissipations to prevent scour of the soil caused by concentrated, height velocity flows. This project will use rip rap, gravel bags, etc. to construct the velocity dissipation devices along concentrated stormwater flow paths with expected turbid runoff.

#### **EC-15 Soil Preparation-Roughening**

- The Contractor shall utilize soil preparation for disturbed soil areas planned for stabilization through vegetation. Soil amendment will be performed by the use of compost, fertilizers, and/or pH soil amendments to promote the right soil conditions for the planned vegetation establishment for the Project.
  - Polluting landscaping materials (fertilizers, pH amendments) shall not be applied to the site within 48 hours prior to a forecasted precipitation event.
  - The Contractor shall store and apply polluting landscaping materials in accordance with WM-1 Material Delivery and Storage, WM-2 Material Use, and WM-3 Stockpile Management.

#### **EC-16 Non-Vegetated Stabilization**

- The Contractor shall consider the application of non-vegetative stabilization to provide sediment control and temporary (or permanent) soil stabilization, or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 4. Non-vegetative stabilization may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
  - As specified in the Project plans.

- The purpose of non-vegetative stabilization methods is to provide exposed soils temporary or permanent stabilization from wind and water erosion.
- This project will use gravel, decomposed granite, rip-rap, etc. applied at 3”-4” in depth to areas identified in the Project landscaping plans and shown in Appendix A: Site Maps, Figures 4
- Non-vegetative Stabilization is possible erosion control BMP, with other options including: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, and/or EC-15 Soil Preparation and Roughening. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

#### **WE-1 Wind Erosion Control**

- The Contractor shall prevent dust nuisance generated from construction activities on the site by applying water and/or soil binder on exposed soil surfaces.
  - When selecting soil binder for wind erosion control, the contractor will refer to the BMP narrative for EC-5 Soil Binder above and the CASQA BMP Fact Sheet in Appendix G.
- The contractor will prevent the discharge of sediment by wind erosion in accordance with the San Joaquin Valley Air Pollution Control District (SJVAPCD) Regulation VIII for fugitive dust control.
- Wind erosion control will be implemented in accordance to water conservation practices (see NS-1 found in Appendix G) as directed by the QSP.

### **3.2.2 Sediment Controls**

Sediment controls are temporary or permanent structural measures that are intended to complement the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water.

The following sediment control BMP selection table indicates the BMPs that will be implemented to control sediment on the construction site. Fact Sheets for temporary sediment control BMPs are provided in Appendix G.

These temporary sediment control BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

**Table 3-3 Temporary Sediment Control BMPs**

CASQA Fact Sheet	BMP Name	Considered for the Project <sup>(1)</sup>	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
SE-1	Silt Fence	✓ <sup>(2)</sup> (3)	✓		
SE-2	Sediment Basin	✓		✓	Using sediment basin for Project excessively expensive. Cheaper sediment controls will be effective.
SE-3	Sediment Trap	✓	✓		
SE-4	Check Dams	✓		✓	No pervious flow channels to use BMP.
SE-5	Fiber Rolls	✓ <sup>(2)</sup> (3)	✓		
SE-6	Gravel Bag Berm	✓ <sup>(3)</sup>	✓		
SE-7	Street Sweeping	✓	✓		
SE-8	Sandbag Barrier	✓	✓		
SE-9	Straw Bale Barrier	✓		✓	Excessive costs. Other linear sediment controls will be just as effective.
SE-10	Storm Drain Inlet Protection	✓ RL2&3	✓		
SE-11	ATS	✓		✓	Excessively expensive and challenging to implement.
SE-12	Manufactured Linear Sediment Controls	✓	✓		
SE-13	Compost Sock and Berm	✓ <sup>(3)</sup>	✓		
SE-14	Biofilter Bags	✓ <sup>(3)</sup>		✓	Not as durable or effective as Gravel Bags.
NA	Passive Treatment System	✓		✓	Excessively expensive and challenging to implement.
TC-1	Stabilized Construction Entrance and Exit	✓	✓		
TC-2	Stabilized Construction Roadway	✓	✓		
TC-3	Entrance Outlet Tire Wash	✓		✓	Excessively expensive and challenging to implement.
<sup>(1)</sup> The 2022 CGPs Fact Sheet Section I.R.1.d through I.R.1.i describes various BMPs that should be considered for use on the construction site. <sup>(2)</sup> The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements. <sup>(3)</sup> All run-on and runoff from the construction site shall be managed. Risk Level 2 and 3 shall provide linear sediment control along toe of slope, face of slope, and at the grade breaks of exposed slope.					

## **EC-1 Silt Fence**

- The QSP and Contractor shall consider the use of silt fence as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected, the Contractor shall:
  - Install the silt fence in accordance with guidance shown in the CASQA Handbook Appendix G, and this BMP narrative section.
- If silt fence is not selected as a perimeter sediment control, the Contractor shall select and implement one of the following alternate BMPs: EC-5 Fiber Rolls, EC-6 Gravel Bag Berm, EC-12 Manufactured Linear Sediment Controls, and/or EC-13 Compost Socks.
- The Contractor shall maintain silt fence by repairing sagging, leaning, and holes. The Contractor shall maintain silt fence by removing accumulated sediment after rain events.

### Materials

- Silt fence fabric should be woven polypropylene with a minimum width of 36 in. and a minimum tensile strength of 100 lb force. The fabric should conform to the requirements in ASTM designation D4632 and should have an integral reinforcement layer. The reinforcement layer should be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric should be between 0.1 sec-1 and 0.15 sec-1 in conformance with the requirements in ASTM designation D4491.
- 2" X 2" wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.
- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.
- There are new products that may use prefabricated plastic holders for the silt fence and use bar reinforcement instead of wood stakes. If bar reinforcement is used in lieu of wood stakes, use number four or greater bar. Provide end protection for any exposed bar reinforcement.

### Implementation

- Trench and key in the bottom of the silt fence at a minimum of 12 in folded towards the direction of anticipated flow. Firmly compact backfilled material.
- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and difficult to maintain.
- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.
- Do not install silt fence as a perimeter control along slopes.
- Do not install silt fence at locations of anticipated concentrated flow.
- Always install silt fence along a level contour. Not doing so will divert and concentrate stormwater and create erosion.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence

## **EC-3 Sediment Trap**

- The QSP and Contractor shall consider the use of sediment trap(s) for the Project at low site locations near stormwater discharge locations (site perimeters or drain inlets) to provide effective sediment control. If selected, the Contractor shall:

- Install an appropriately sized sediment trap to temporarily contain stormwater from the anticipated run-on area,
- Not use sediment traps for run-on areas larger than five acres.
- Be used in conjunction with polypropylene fabrics per EC-7 and rip-rap per EC-16 to stabilize the designed outfall structure from scouring caused by concentrated discharge flow.
- The Contractor shall install sediment trap(s) as a form of drain inlet protection for drain inlets in disturbed drainage areas greater than one acre, where feasible based on site layout. Sediment traps are the most effective sediment control to remove sediment from high flows while preventing regional flooding.
- If the Contractor chooses not to implement sediment trap(s), the Contractor shall install and maintain effective sediment controls including: EC-1 Silt Fence, EC-5 Fiber Rolls, EC-6 Gravel Bag Berm, EC-12 Manufactured Linear Sediment Controls, and/or EC-13 Compost Socks.

### **EC-5 Fiber Rolls**

- The QSP and Contractor shall consider the use of fiber rolls as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected:
  - The Contractor shall install fiber rolls shown in Appendix A: Site Map, Figures 2 through 4 to site perimeters prior to commencing grading.
  - Fiber rolls are not appropriate as the only BMP at a site and shall be used in conjunction with other erosion and sediment control measures to reduce pollutant discharges.
  - Fiber rolls shall be installed with “j-hooks” upgrade to prevent stormwater from flowing around the fiber roll.
  - Fiber rolls shall be maintained by the contractor to ensure effective sediment control. The exact location of fiber rolls will be determined in the field by the QSP.
  - Fiber rolls must be secured (staked) to the ground in a trench that is 1/4 to 1/3 of the thickness of the roll, with a width the same diameter as the roll.
  - Fiber rolls used on this project will be eight to twelve inches in diameter unless the QSP specifies otherwise.
  - The Contractor shall repair or replace fiber rolls that are split, torn, unraveling or slumping.
- If fiber rolls are not selected as a perimeter sediment control, the Contractor shall select and implement one of the following alternate BMPs: EC-1 Silt Fence, EC-6 Gravel Bag Berm, EC-12 Manufactured Linear Sediment Controls, and/or EC-13 Compost Socks.
- The Contractor shall not use fiber rolls as drain inlet protection.

### **EC-6 Gravel Bag Berm**

- Gravel bag berms are typically more expensive and labor intensive than alternate linear sediment controls like fiber rolls and compost socks. Gravel bag berms (as well as compost socks) provide a more porous linear control that filters sediment and other pollutants out of stormwater where fiber rolls do not.
- The QSP and Contractor shall consider the use of gravel bag berms as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected:
  - The Contractor shall gravel bag berms shown in Appendix A: Site Map, Figures 2 through 4 to site perimeters prior to commencing grading.
  - Gravel bag berms are not appropriate as the only BMP at a site and shall be used in conjunction with other erosion and sediment control measures to reduce pollutant discharges.
  - Gravel bag berms shall be installed with “j-hooks” upgrade to prevent stormwater from flowing around the fiber roll.
  - Gravel bag berms shall be maintained by the contractor to ensure effective sediment control. The exact location of fiber rolls will be determined in the field by the QSP.

- Fiber rolls must be secured (staked) to the ground in a trench that is  $\frac{1}{4}$  to  $\frac{1}{3}$  of the thickness of the roll, with a width the same diameter as the roll.
- The Contractor shall size each gravel bag berm (height, width, shape) in accordance with EC-6 in the CASQA BMP Handbook found in Appendix G.
- The Contractor shall repair or replace gravel bags that are split, torn, or unraveling and remove any spilled gravel.

### **EC-7 Street Sweeping and Vacuuming**

- The Contractor shall reduce the discharge of pollutants from the Project site by:
  - Sweeping and /or vacuuming the streets and roadways adjacent to the Project site. The Project site and off-site exits shall be inspected daily for track out.
  - Sweeping sediment observed on internal site pavement that drains to drain inlets or off-site areas prior to rain events.
  - Sweeping and/or vacuum the streets and roadways adjacent to the Project site in accordance with SJVAPCD's Regulation VIII on fugitive dust control.
- The Contractor shall limit speed of vehicles to control dust.

### **EC-8 Sandbag Barrier**

- The Contractor shall use sandbag barriers as a BMP to:
  - Divert stormwater away from disturbed soil areas,
  - Divert stormwater away from steeper disturbed slopes,
  - Divert stormwater in a way that reduces drainage areas and resulting downgrade stormwater flow concentration,
  - As an optional material for use of constructing a sediment trap.
- The Contractor shall not install a linear sandbag barrier on a slope except along the slope contour.
- The Contractor shall replace damaged sandbags and remove any lost material.
- The Contractor shall use a pyramid approach when stacking sand bags, and follow the berm sizing (height, width, shape) listed in Appendix G: CASQA BMP Handbook.

### **EC-10 Storm Drain Inlet Protection**

- Storm drain inlet protection will be used at all operational internal inlets to the storm drain system as shown on Appendix A: Site Map, Figures 2 through 4, and in accordance with the BMP Manual. Additional locations may be required based on actual field conditions/observations and such locations will be determined by the QSP.
- Inlets will be protected from stormwater discharge with the use of gravel bag berms, gravel bag j-weirs in gutters, sediment traps, silt fence, and/or pre-manufactured storm drain inlet inserts for drain inlet protections.
  - Silt fence shall be the primary choice of drain inlet protection **where/when feasible**. Silt fence as a drain inlet protection shall be installed according to EC-10 in the CASQA BMP Handbook, found in Appendix G. Conditions that will require the use of silt fence for the Project include:
    - When storm drain inlets are located in a pervious surrounding that provides an area that will allow stormwater to pool without resulting in flooding that will cause a public hazard or property damage.
  - Gravel bag berms and pre-manufactured storm drain inlet inserts shall be the secondary choice of drain inlet protections.



- Gravel bag berms shall be sized to be up to 24” tall in a pyramid shape, but shorter if too high of a gravel bag berm would cause undesirable diversion of stormwater.
  - Gravel bag j-weirs shall be placed in **all** gutters expected to convey turbid stormwater from disturbed site areas. The Contractor shall install two to three sets of gravel bag j-weirs along gutters where the j-weir spans the width of the concrete gutter and the length is at least three times as long as the width. The QSP shall determine the exact location and arrangement of j-weirs.
  - Sediment traps shall be installed adjacent to drain inlets anticipated to receive stormwater from an area greater than approximately 1 acre, when feasible based on site layout.
- All storm drain inlet protections shall be inspected after rain events and maintained by removing accumulated sediment, re-arranging of materials, replacement of materials, etc. Sediment traps shall be maintained after rain events to remove accumulated sediment to ensure deposited sediment is not resuspended into stormwater.
- Filter fabric shall not be used as a drain inlet protection.

### **EC-12 Manufactured Linear Sediment Controls**

- The QSP and Contractor shall consider the use of manufactured linear sediment controls (MLSCs) as a substitute to EC-1 Silt Fence, EC-5 Fiber Rolls, EC-8 Gravel Bag Barrier, and EC-9 Sandbag Barrier. MLSCs come in a variety of products and should be considered for the following reasons:
  - Providing perimeter controls on pavement.
  - As a more re-usable perimeter control than fiber rolls and silt fence.
- The Contractor shall install any MLSCs according to the manufacturer’s specification.

### **EC-13 Compost Sock and Berm**

- The QSP and Contractor shall consider the use of compost socks and/or berms as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected:
  - The Contractor shall install compost socks and/or berms as shown in Appendix A: Site Map, Figures 2 through 4 to site perimeters prior to commencing grading.
  - Compost socks and/or berms are not appropriate as the only BMP at a site and shall be used in conjunction with other erosion and sediment control measures to reduce pollutant discharges.
  - Compost socks and/or berms shall be installed with “j-hooks” upgrade to prevent stormwater from flowing around the compost socks and/or berms.
  - Compost socks and/or berms shall be maintained by the contractor to ensure effective sediment control. The exact location of compost socks and/or berms will be determined in the field by the QSP.
  - Compost socks shall not be punctured with stakes. Compost socks typically do not need to be secured with stakes or placed in trenches due to their weight.
  - The Contractor shall repair or replace compost socks and/or berms that are split, torn, unraveling or slumping.
- If compost socks and/or berms are not selected as a perimeter sediment control, the Contractor shall select and implement one of the following alternate BMPs: EC-1 Silt Fence, EC-5 Fiber Rolls, EC-6 Gravel Bag Berm, and/or EC-12 Manufactured Linear Sediment Controls.
- The QSP and Contractor shall consider the use of compost socks and/or berms for areas of slopes with expected high sheet flow amounts due to their filtering properties.
- The QSP and Contractor shall consider the use of compost socks and/or berms for slopes that are planned for vegetation establishment for final stabilization due to their ability to provide nutrients to soil.

- The Contractor shall not use compost socks as drain inlet protection due to their risk of discharging nutrients.
- The Contractor shall source compost and other materials in accordance with the guidance in Appendix G: CASQA BMP Factsheet.

#### **TC-1 Stabilized Construction Entrance and Exit**

- The Contractor shall ensure that construction activity traffic to and from the project is limited to entrances and exits that employ effective controls to prevent off-site tracking of sediment. A stabilized construction entrance is a pad of rip-rap underlain with polypropylene fabric. Stabilized Construction Entrance/Exits shall be implemented where existing pavement meets exposed disturbed soil areas of the project, as shown in Exhibit A: Site Maps, Figures 2 through 4, or in an equivalent location approved by the QSP, landowner, and any relevant City, County, or other right-of-way owners.
- The Contractor shall limit speed of vehicles to control dust. Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment. Remove aggregate, separate and dispose of sediment when construction entrance becomes clogged with sediment.

#### **TC- 2 Stabilized Construction Roadway**

The Contractor may utilize a newly constructed stabilized construction roadway, if necessary, to prevent sediment track out and to control dust. The Contractor shall monitor their Stabilized Construction Entrance and Exit, as described in the previous section, throughout the day and sweep the pavement of sediment immediately if sediment has accumulated on the pavement and is contributing to airborne dust.

### **3.3 NON-STORMWATER CONTROLS AND WASTE AND MATERIALS MANAGEMENT**

#### **3.3.1 Non-Stormwater Controls**

Non-stormwater discharges into storm drainage systems or waterways which are not authorized under the 2022 CGP are prohibited. Non-stormwater discharges for which a separate NPDES permit is required by the local Regional Water Board are prohibited unless coverage under the separate NPDES permit has been obtained for the discharge. The selection of non-stormwater BMPs is based on the list of construction activities with a potential for non-stormwater discharges identified in Section 2.7 of this SWPPP.

The following non-stormwater control BMP selection table indicates the BMPs that will be implemented to control sediment on the construction site. Fact Sheets for temporary non-stormwater control BMPs are provided in Appendix G.

Non-stormwater BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

**Table 3-4 Temporary Non-Stormwater BMPs**

CASQA Fact Sheet	BMP Name	Considered for the Project <sup>(1)</sup>	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
NS-1	Water Conservation Practices	✓	✓		
NS-2	Dewatering Operation	✓	✓		
NS-3	Paving and Grinding Operation	✓	✓		
NS-4	Temporary Stream Crossing	✓		✓	No stream crossings.
NS-5	Clear Water Diversion	✓		✓	No water diversions.
NS-6	Illicit Connection/Discharge	✓	✓		
NS-7	Potable Water/Irrigation	✓	✓		
NS-8	Vehicle and Equipment Cleaning	✓	✓		
NS-9	Vehicle and Equipment Fueling	✓	✓		
NS-10	Vehicle and Equipment Maintenance	✓	✓		
NS-11	Pile Driving Operation	✓		✓	No pile driving.
NS-12	Concrete Curing	✓	✓		
NS-13	Concrete Finishing	✓	✓		
NS-14	Material and Equipment Use Over Water	✓		✓	No equipment over water.
NS-15	Demolition Removal Adjacent to Water	✓		✓	No demolition adjacent to water.
NS-16	Temporary Batch Plants	✓		✓	No temporary batch plant.
<sup>(1)</sup> The 2022 CGP Fact Sheet Section I.R.1.d through I.R.1.i describes various BMPs that should be considered for use on the construction site.					

## **NS-1 Water Conservation Practices**

Water conservation practices are a non-stormwater discharge management measure that consists of activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Generally, the Contractor shall:

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Use nozzles on hoses that shut off when not in use.
- Washing of vehicles and equipment on the construction site is prohibited unless an emergency.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.
- Direct construction water runoff to areas where it can soak into the ground or be collected and reused.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.
- Install sediment and erosion control measures to non-stormwater use areas as needed if there is the potential to cause erosion or scour.
- Repair water equipment as needed to prevent unintended discharges, including but not limited to:
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant/water source connections

## **NS-2 Dewatering Operation**

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation must be removed from a work location so that construction work may be accomplished. Non-stormwater includes, but is not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area.

These practices are implemented for discharges of non-stormwater from construction sites. Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (stormwater) from depressed areas at a construction site. Stormwater mixed with non-stormwater should be managed as non-stormwater.

- Dewatering non stormwater cannot be discharged without prior notice to and approval from the RWQCB and local stormwater management agency (i.e., the Fresno Metropolitan Flood Control

District). This includes stormwater that is co-mingled with groundwater or other non-stormwater sources. Once the discharge is allowed, appropriate BMPs must be implemented to ensure the discharge complies with all permit requirements and regional and watershed specific requirements.

- RWQCB may require a separate NPDES permit prior to the dewatering discharge of non-stormwater. These permits will have specific testing, monitoring, and discharge requirements and can take significant time to obtain.
- The QSP will coordinate monitoring and permit compliance.
- Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges must not cause erosion at the discharge point.
- The QSP and Contractor shall review the CASQA BMP Factsheet in Appendix G to determine the appropriate equipment needed to conduct off-site dewatering operations in a manner that prevents the violation of water quality standards. One or more of the following equipment shall be considered for use:
  - Weir tanks, dewatering tanks, gravity bag filter, sand media particulate filter, and pressurized bag filter.

### **NS-3 Paving and Grinding Operation**

The Contractor shall prevent or reduce the discharge of pollutants from paving operations, using measures to prevent run-on and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

These procedures shall be implemented where paving, surfacing, resurfacing, or saw cutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

- **Avoid paving during the wet season when feasible.**
- **Reschedule paving and grinding activities if rain is in the forecast.**
- Store materials away from drainage courses to prevent stormwater run-on (see WM-1, Material Delivery and Storage).
- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. Materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC and AC waste should be in conformance with WM-8, Concrete Waste Management.

#### **Saw cutting, grinding, and pavement removal**

- The Contractor shall shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to prevent any discharge of slurry.
- When paving involves AC, the Contractor shall follow the following steps prevent the discharge of grinding residue, un-compacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:

- AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drains or watercourses. This shall be accomplished by the use of effective sediment control BMPs.
- Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations shall be picked up by means of a vacuum attachment to the grinding machine, shall not be allowed to flow across the pavement, and shall not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Dig out activities should not be conducted in the rain.
- Collect dig out material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
- If dig out material cannot be recycled, transport the material back to an approved storage site.

#### Asphaltic Concrete Paving

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.
- Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

#### Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile or dispose of properly.
- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if allowed by the local wastewater authority.

#### Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized.
- Drainage inlet structures and manholes shall be covered with filter fabric during application of seal coat, tack coat, slurry seal, and fog seal.
- Seal coat, tack coat, slurry seal, or fog seal shall not be applied if rainfall is predicted to occur during the application or manufacturer's specified curing period.

#### Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use.
- Clean up spills with absorbent materials rather than burying. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.
- Substances used to coat asphalt transport trucks, and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.
- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

## **NS- 6 Illicit Connection/Discharge**

This is a non-stormwater management control that includes procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.

This BMP applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered, or illegally dumped material is found on the construction site.

- The QSP and Contractor shall review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- The QSP shall inspect the site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions.
- Unlabeled and unidentifiable material should be treated as hazardous.
- **Solids** - Look for debris, or rubbish piles. Solid waste dumping often occurs on roadways with light traffic loads or in areas not easily visible from the traveled way.
- **Liquids** - signs of illegal liquid dumping or discharge can include:
  - Visible signs of staining or unusual colors to the pavement or surrounding adjacent soils,
  - Pungent odors coming from the drainage systems,
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes,
  - Abnormal water flow during the dry weather season.
- **Urban Areas** - Evidence of illicit connections or illegal discharges is typically detected at storm drain outfall locations or at manholes. Signs of an illicit connection or illegal discharge can include:
  - Abnormal water flow during the dry weather season,
  - Unusual flows in sub drain systems used for dewatering,
  - Pungent odors coming from the drainage systems,
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes,
  - Excessive sediment deposits, particularly adjacent to or near active offsite construction projects.
- **Cleanup and Removal** - The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the Project proponent and local stormwater management agency for further information.

## **NS-7 Potable Water/Irrigation**

This is a non-stormwater management control for potable water/irrigation that consists of practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation

water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing.

Implement this BMP whenever potable water or irrigation water discharges occur to or from a construction site.

- Direct water from offsite sources around or through a construction site, where feasible, in a way that minimizes contact with the construction site.
- Discharges from water line flushing should be reused for landscaping purposes where feasible.
- Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow
- Protect downstream stormwater drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.
- Inspect irrigated areas within the construction limits for excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used and to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.

## **NS-8 Vehicle and Equipment Cleaning**

- The Contractor shall not clean vehicles or equipment with water and/or soaps on-site. The Contractor shall wash all equipment off-site (with the exception of concrete truck washout).
- The Contractor shall use dry cleaning methods (rags) for cleaning equipment of grease and residues. Used rags shall be stored in watertight containers for re-use or disposed of as hazardous waste.
- If equipment must be washed with water on-site, the Contractor shall follow the procedures outlined in Appendix G: CASQA BMP Handbook.

## **NS-9 Vehicle and Equipment Fueling**

Vehicle and equipment fueling procedures and practices are designed to prevent fuel spills and leaks and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel and implementing spill controls.

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

- Onsite vehicle and equipment fueling shall only be used where it is impractical to send vehicles and equipment offsite for fueling.
- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage “topping-off” of fuel tanks.
- Absorbent spill cleanup materials and spill kits shall be available in fueling areas and on fueling trucks, and shall be disposed of properly after use.
- Drip pans or absorbent pads shall be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.



- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- When fueling must take place onsite, designate an area away from drainage courses to be used.
- Dedicated fueling areas shall be protected from stormwater run-on and run-off, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent run-on, run-off, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by the SJVAPCD.
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks

### **NS-10 Vehicle and Equipment Maintenance**

This is a non-stormwater management measure used to prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a “dry and clean site”. The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair.

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must be done onsite, use designated areas, located away from drainage courses.
- Dedicated maintenance areas should be protected from storm water run-on and run-off and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Look for leaks of fluids or oil from vehicles and equipment, at start up and repair immediately or place out of service with drip pans or buckets to contain the leaked material. Properly dispose of leaked material

- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.

## **NS-12 Concrete Curing**

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. Proper procedures reduce or eliminate the contamination of stormwater runoff during concrete curing.

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

- For chemical concrete curing:
  - Avoid over spray of curing compounds.
  - Minimize the drift of chemical cure as much as possible by applying the curing compound close to the concrete surface.
  - Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.
  - Use proper storage and handling techniques for concrete curing compounds. Refer to WM- 1, Material Delivery and Storage.
  - Protect drain inlets prior to the application of curing compounds.
  - Refer to WM-4, Spill Prevention and Control.
- For water concrete curing:
  - Direct cure water away from inlets and watercourses to collection areas for infiltration or other means of removal in accordance with all applicable permits.
  - Collect cure water at the top of slopes and transport or dispose of water in a non-erodible manner.
  - Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

## **NS-13 Concrete Finishing**

Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Methods include sand blasting, shot blasting, grinding, or high pressure water blasting. Stormwater and non-stormwater exposed to concrete finishing by-products may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate non stormwater management measures can minimize the impact that concrete finishing methods may have on stormwater and non-stormwater discharges.

These procedures apply to all construction locations where concrete finishing operations are performed.

- Divert blasting water to a collection/containment area.
- Collect and properly dispose of water from high-pressure water blasting operations.
- Collect contaminated water from blasting operations at the top of slopes. Transport or dispose of contaminated water while using BMPs such as those for erosion control.
- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering).
- Protect inlets during sandblasting operations.
- Minimize the drift of dust and blast material as much as possible by keeping the blasting nozzle close to the surface.
- When blast residue contains a potentially hazardous waste, refer to WM-6, Hazardous Waste Management.

### **3.3.2 Materials Management and Waste Management**

Materials management control practices consist of implementing procedural and structural BMPs for handling, storing, and using construction materials to prevent the release of those materials into stormwater discharges. The amount and type of construction materials to be utilized at the Site will depend upon the type of construction and the length of the construction period. The materials may be used continuously, such as fuel for vehicles and equipment, or the materials may be used for a discrete period, such as soil binders for temporary stabilization.

Waste management consist of implementing procedural and structural BMPs for handling, storing, and ensuring proper disposal of wastes to prevent the release of those wastes into stormwater discharges.

Materials and waste management pollution control BMPs will be implemented to minimize stormwater contact with construction materials, wastes, and service areas; and to prevent materials and wastes from being discharged off-site. The primary mechanisms for stormwater contact that shall be addressed include:

- Direct contact with precipitation
- Contact with stormwater run-on and runoff
- Wind dispersion of loose materials
- Direct discharge to the storm drain system through spills or dumping
- Extended contact with some materials and wastes, such as asphalt cold mix and treated wood products, which can leach pollutants into stormwater.

A list of construction activities is provided in Section 2.6. The following Materials and Waste Management BMP selection table, Table 3-5, indicates the BMPs that shall be implemented to handle materials and control construction site wastes associated with these construction activities. Fact Sheets for Materials and Waste Management BMPs are provided in Appendix G.

Material management BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

**Table 3-5 Temporary Materials Management BMPs**

CASQA Fact Sheet	BMP Name	Considered for Project <sup>(1)</sup>	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
WM-01	Material Delivery and Storage	✓	✓		
WM-02	Material Use	✓	✓		
WM-03	Stockpile Management	✓	✓		
WM-04	Spill Prevention and Control	✓	✓		
WM-05	Solid Waste Management	✓	✓		
WM-06	Hazardous Waste Management	✓	✓		
WM-07	Contaminated Soil Management			✓	There is no identified contaminated soil at the Project site.
WM-08	Concrete Waste Management	✓	✓		
WM-09	Sanitary-Septic Waste Management	✓	✓		
WM-10	Liquid Waste Management	✓	✓		
<sup>(1)</sup> The 2022 CGP Fact Sheet Section I.R.1.d through I.R.1.i describes various BMPs that should be considered for use on the construction site.					

## **WM-1 Material Delivery and Storage**

This waste management and pollution control measure is used to prevent, reduce, or eliminate the discharge of pollutants by minimizing the storage of hazardous materials on site, storing materials in a designated area, installing secondary containment, and conducting regular inspections.

Material delivery and storage control measures apply to soil stabilizers and binders; Pesticides and herbicides; Fertilizers; Detergents; Plaster, Petroleum products such as fuel, oil, and grease; Asphalt and concrete components; Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds; Concrete compounds; and other materials that may be detrimental if released to the environment.

### *Delivery & Storage*

- Generally, construction materials should be stored off the ground, under cover, and, in temporary containment areas in certain cases.
- Material Safety Data Sheets (MSDS) shall be available for all materials stored on-site in the on-site job trailer.
- Designate areas on site for material delivery and storage areas.
- Material delivery and storage areas shall be located near the construction entrances, away from drainage areas, watercourses, and heavy traffic areas if possible.
- Place containment areas in an area which will be paved if possible.
- Install a stabilized entrance at the entrance to the storage area if vehicles or equipment will enter from a paved surface to an unpaved storage area.
- Stockpiles shall be protected in accordance with WM-3, Stockpile Management.
- Materials shall be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced as soon as possible.
- Materials should be stored indoors within existing structures or sheds when available. If this is not feasible, materials shall be covered by a fully secured impervious tarp.
- If stored outside, cover and store liquids, chemicals, boxed materials, drums, and materials with the potential to migrate during a storm on pallets, away from water courses and in secondary containment such as earthen dikes, horse troughs, or even a children's wading pool or "bus boy trays" for non-reactive materials such as detergents, oil, grease, and paints.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be placed in temporary secondary containment facilities for storage.

### *Containment Facility*

- A temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility shall be impervious to the materials stored for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids shall be sent to an approved disposal site.

- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
- Throughout the rainy season, each temporary containment facility shall be covered during nonworking days, prior to, and during rain events.

#### Hazardous or Regulated Materials

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Chemicals should be kept in their original labeled containers.
- An ample supply of appropriate spill clean-up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous materials.
- If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil. See WM-7, Contaminated Soil Management in Appendix G: CASQA BMP Handbook. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.

#### Spills

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.

### **WM-2 Material Use**

This waste management and materials pollution control is implemented to prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products if available, and minimizing hazardous material uses onsite.

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides,
- Fertilizers,
- Detergents,
- Petroleum products such as fuel, oil, and grease,
- Asphalt and other concrete components,
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds,
- Other materials that may be detrimental if released to the environment.

The following steps should be taken to minimize risk of stormwater pollution from material use:

- Reduce and minimize use of hazardous materials onsite when practical.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals. Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioner's license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed.
- Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydro seeding. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains.
- Keep Material Safety Data Sheets (MSDS) for all materials on site.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or into a concrete washout pit or other lined liquid waste container.
- For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, nontreated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible.
- Keep an ample supply of spill clean-up material near use areas.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.

### **WM-3 Stockpile Management**

Stockpile management procedures and practices is a waste management and materials pollution control. Stockpile Management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, paving materials such as Portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt binder (so called "cold mix" asphalt), and pressure treated wood.

Implement in all stockpiles of soil and other loose materials.

- Locate stockpiles a minimum of 50 ft away from concentrated flows of stormwater, drainage courses, and inlets.
- Protect all stockpiles from stormwater run on using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, sandbag, or gravel bags.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.



- All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.
- Stockpiles of concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, and aggregate sub base shall be covered and protected with a temporary perimeter sediment barrier at all times.

#### Stockpiles of polluting materials

- Asphalt cold mix, fly ash, stucco, and hydrated lime stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.
- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

#### Protection of Active Stockpiles

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of “cold mix” and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff

### **WM-4 Spill Prevention and Control**

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees. This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see WM-5 Liquid Waste Management and WM-10 solid Waste Management.

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- |                            |                                |
|----------------------------|--------------------------------|
| • Soil stabilizers/binders | • Deicing/anti-icing chemicals |
| • Dust palliatives         | • Fuels                        |
| • Herbicides               | • Lubricants                   |
| • Growth inhibitors        | • Other petroleum distillates  |
| • Fertilizers              |                                |

#### Implementation

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, and substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater run-on during rainfall to the extent that it doesn't compromise clean-up activities.
- Do not bury or wash spills with water.
- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well-organized, and equipped with ample clean supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

#### Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See WM-5 Waste Management and WM-7 contaminated soils in this section for specific information.
- Report all spills to the Project QSP immediately. A spill may trigger stormwater sampling for non-visible pollutants.

#### Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled at the discovery of the spill.
- Contain the spread of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Notify the project foreman immediately.
- Recover spilled materials.
- Clean the contaminated area and properly dispose of contaminated materials.

- If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
- If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
- If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

#### Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities. Spills should be cleaned up immediately.

#### Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper City or County officials. All emergency phone numbers will be posted at the construction site.
  - Contact the site superintendent. For spills of federal reportable quantities, (examples are listed below) in conformance with the requirements in 40 CFR parts 110,119, and 302, the site superintendent will notify the National Response Center at (800) 424-8802. The superintendent will notify the Regional Water Quality Control Board and any other applicable agencies.
- The services of a spill contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
- Notification should first be made by telephone and followed up with a written report.
- Other agencies which may need to be consulted include, but are not limited to, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

#### Sampling

- If there is evidence that the spilled material was discharged offsite, follow the appropriate sampling protocol (stormwater, non-stormwater or non-visible discharges) located in the CSMP.

#### Vehicle and Equipment Maintenance

- If maintenance must be performed onsite, use a designated area and secondary containment, located away from drainage courses, to prevent the run on of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.

- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

#### Vehicle and Equipment Fueling

- If fueling must be performed onsite, designate areas located away from drainage courses to prevent the run on of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

#### Typical Reportable Quantities for Construction Sites

<u>Material</u>	<u>Released to</u>	<u>Quantity</u>
Engine Oil, Fuel Hydraulic & Brake Fluid	Land	25 Gallons
Engine Oil, Fuel Hydraulic & Brake Fluid	Water	Visible Sheen
Gasoline	Land or Water	32 Gallons
Anti-Freeze	Land or Water	5000 lbs (539 Gallons)
Engine Degreaser	Land or Water	100 lbs (10 Gallons)

### **WM-5 Solid Waste Management**

Solid waste management procedures and practices are a waste management and pollution control designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Provide an adequate number of containers for the amount of trash that will be generated from the site with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Trash receptacles with lids shall be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Solid waste storage areas should be located away from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Stormwater run-on shall be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Collect site trash daily, especially during rainy and windy conditions and cover receptacles at the end of each business day or while not in use.

- Collected litter and debris should not be stored next to inlets, drainage systems, or watercourses.
- Waste containers, dumpsters, & trash receptacles must be covered at the end of the work day and in the event of rain or significant wind.
- Arrange for regular waste collection before containers overflow.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines shall be a priority.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Clean up immediately if a waste container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal facilities.
- Littering on the project site is prohibited.

## **WM-6 Hazardous Waste Management**

This hazardous waste management measure is a waste management and pollution control measure that applies to all construction projects to prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of associates and subcontractors.

Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products, Asphalt Products, Concrete Curing Compounds, Pesticides, Palliatives, Acids, Septic Wastes, Paints, Stains, Solvents, Wood Preservatives, Roofing Tar and any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302.

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

### **Implementation**

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers shall be stored in temporary containment facilities that comply with the following requirements:
  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
  - Minimize production or generation of hazardous materials and hazardous waste on the job site.

- Use containment berms in fueling and maintenance areas and where the potential for spills is high.
- Segregate potentially hazardous waste from non-hazardous construction site debris.
- Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.
- Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
- Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
- Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.
- Drums should not be overfilled, and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil-based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
  - Place hazardous waste containers in secondary containment.
  - Do not allow potentially hazardous waste materials to accumulate on the ground.
  - Do not mix wastes.
  - Use the entire product before disposing of the container.

- Do not remove the original product label; it contains important safety and disposal information.

#### Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

#### Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

### **WM-8 Concrete Waste Management**

The use of concrete waste managing measures including, concrete washouts, are waste management and pollution controls that prevent or reduce the discharge of pollutants to stormwater from concrete waste products conducting washout offsite or onsite in a designated area.

#### Suitable Applications

Concrete waste management procedures and practices shall be implemented on the Project where:

- Concrete is used as a construction material or where concrete dust and debris results from demolition activities.
- Slurries containing Portland cement concrete or asphalt concrete are generated, such as from saw cutting, coring, grinding, and hydro-concrete demolition.
- Concrete trucks and other concrete coated equipment area washed on site.
- Mortar-mixing stations and equipment.

#### Implementation

- Concrete washout containers shall consist of water tight plastic tubs over a bermed liner for secondary containment that accommodates access by concrete trucks.
- Arrange for pumping or accumulated slurry/water capacity is 75%.
- Place downstream as far as possible from storm drains, open ditches, and waterbodies.
- Place in a location that allows convenient access for concrete trucks, preferably near the area where concrete is being poured.
- Place far from construction traffic to reduce the likelihood of damage.
- The size and number of concrete washout facilities shall be appropriate for the anticipated amount of concrete waste.
- To prevent leaks, use prefabricated concrete washout containers that are watertight.
- Store dry and wet materials under cover and away from drainage areas.
- Avoid mixing of excess amounts of fresh concrete.
- Perform washout of concrete trucks offsite or in designated washout areas.
- Do not wash out concrete trucks into the soils, into storm drains, open ditches, streets, or water bodies.
- Do not dump excess concrete on non-designated concrete waste areas.

#### Concrete Slurry Wastes

- Residue from grinding operations should be picked up by means of vacuum attachment.
- Saw cutting residue shall not be allowed to flow across pavement and should not be left on the surface of pavement. See NS-3 Paving and Grinding Operations.
- Slurry residue should be vacuumed and disposed in a temporary put. Dispose of dry slurry residue in accordance with solid waste management WM-5.

### **WM-9 Sanitary-Septic Waste Management**

Proper sanitary and septic waste management are waste management and material pollution controls that prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, an arranging for regular service and disposal.

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

#### Implementation

- Shall be located away from drainage facilities, watercourses, and from traffic circulation.
- Provide a sufficient quantity of facilities to accommodate the workforce.
- Ensure containment of sanitation facilities to prevent discharge of pollutants to the stormwater drainage system or the receiving water.
- When subjected to high winds or risk of high winds, temporary sanitary facilities shall be secured to prevent overturning.
- Sanitary facilities should be located in a convenient location.
- Sanitary or septic wastes shall be treated or disposed of in accordance with state and local requirements.
- Sanitary facilities shall be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.



- Do not discharge or bury sanitary waste within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, shall comply with the local health agency, city, county, and sewer district requirements.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.

## **WM-10 Liquid Waste Management**

Liquid waste management is a waste management and materials pollution control that includes procedures and practices to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes

Liquid waste management is applicable to construction projects that generate any of the following nonhazardous by-products, residuals, or wastes:

- Drilling slurries and drilling fluids.
- Grease-free and oil-free wastewater and rinse water.
- Dredgings.
- Other non-stormwater liquid discharges not permitted by separate permits.

### Limitations

- Disposal of some liquid wastes may be subject to specific laws and regulations or to requirements of other permits secured for the construction project (e.g., NPDES permits, Army Corps permits, Coastal Commission permits, etc.).
- Liquid waste management does not apply to dewatering operations (NS-2 Dewatering Operations), solid waste management (WM-5, Solid Waste Management), hazardous wastes (WM-6, Hazardous Waste Management), or concrete slurry residue (WM-8, Concrete Waste Management).
- Typical permitted non-stormwater discharges can include: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; flows from riparian habitats and wetlands; and discharges or flows from emergency fire-fighting activities.

### Implementation

#### *Containing Liquid Wastes*

- Drilling residue and drilling fluids should not be allowed to enter storm drains and watercourses and should be disposed of.
- If an appropriate location is available, drilling residue and drilling fluids that are exempt under Title 23, CCR § 2511(g) may be dried by infiltration and evaporation in a containment facility constructed in conformance with the provisions concerning the Temporary Concrete Washout Facilities detailed in WM-8, Concrete Waste Management.
- Liquid wastes generated as part of an operational procedure, such as water-laden dredge material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.
- Liquid wastes should be contained in a controlled area such as a holding pit, sediment basin roll-off bin, or portable tank.
- Containment devices must be structurally sound and leak free.
- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated.

#### *Capturing Liquid Wastes*

- Capture all liquid wastes that have the potential to affect the storm drainage system (such as wash water and rinse water from cleaning walls or pavement), before they run off a surface.
- Do not allow liquid wastes to flow or discharge uncontrolled. Use temporary dikes or berms to intercept flows and direct them to a containment area or device for capture.
- Use a sediment trap (SE-3, Sediment Trap) for capturing and treating sediment laden liquid waste or capture in a containment device and allow sediment to settle.

#### *Disposing of Liquid Wastes*

- A typical method to handle liquid waste is to dewater the contained liquid waste, using procedures such as described in NS-2, Dewatering Operations, and SE-2, Sediment Basin, and dispose of resulting solids per WM-5, Solid Waste Management.
- Methods of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 or 404 permits, and local agency discharge permits, etc. Review the SWPPP to see if disposal methods are identified.
- Liquid wastes, such as from dredged material, may require testing and certification whether it is hazardous or not before a disposal method can be determined.
- For disposal of hazardous waste, see WM-6, Hazardous Waste Management.
- If necessary, further treat liquid wastes prior to disposal. Treatment may include, though is not limited to, sedimentation, filtration, and chemical neutralization.

### **3.4 TMDL-RELATED BMPS**

There are no required TMDL-related BMPS for the Project since the Project does not discharge to a water body with TMDLs.

### **3.5 POST CONSTRUCTION STORMWATER MANAGEMENT MEASURES**

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate pollutant discharges from the site after construction is completed.

This site is subject to the post-construction requirements of an existing NPDES Phase I or Phase II MS4.      ☒      Yes      ☐      No

The post construction runoff reduction requirements have been satisfied through the Fresno Metropolitan Flood Control District MS4 program, this project is exempt from 2022 CGP Provision IV.N.3. The MS4's post construction requirements were uploaded as part of the PRDs as required by 2022 CGP Provision IV.N.2.

## **Section 4     BMP Inspection and Maintenance**

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### **4.1             BMP INSPECTION AND MAINTENANCE**

The 2022 CGP requires routine weekly inspections of BMPs, along with inspections before, during, and after qualifying precipitation events. A BMP inspection checklist must be filled out for inspections and maintained on-site with the SWPPP. The inspection checklist must include the necessary information covered in Section 7.6. A blank BMP Inspection Form can be found in Appendix H. Completed forms will be kept in Appendix N.

Maintenance, repair, or design and implementation of new BMPs alternatives will be begin within 72 hours of the identification of failures or other shortcomings. Corrections will be completed as soon as possible, prior to the next forecasted precipitation event (2022 CGP Appendix D Section II.J).

The QSP will verify that all BMP maintenance and repairs were appropriately implemented during the next visual inspection following completion.

The QSP may delegate BMP maintenance and repair verification to an appropriately trained QSP Delegate.

Specific details for maintenance, inspection, and repair of Construction Site BMPs can be found in the BMP Factsheets in Appendix G.

## Section 5 Training

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Appendix J identifies the QSPs and QSP Delegates for the project. To promote stormwater management awareness specific for this project, periodic training of job-site personnel will be included as part of routine project meetings (e.g., daily/weekly tailgate safety meetings), or task specific training as needed. Refresher training will be provided as necessary.

The QSP will be responsible for providing this information at the meetings, and subsequently completing the Training Reporting Form shown in Appendix I, which identify the site-specific stormwater topics covered as well as the names of site personnel who attended the meeting.

The QSP may delegate specific tasks to trained QSP Delegates who have received the following training based on the guidelines developed by the Construction General Permit Training Team.

1. **Foundational training** for all QSP Delegate(s) regarding stormwater compliance roles and responsibilities, forecast information, and documentation and reporting procedures; and
2. **Site-specific training** regarding visual inspections, sampling procedures, and/or SWPPP and BMP implementation activities relevant to the responsibilities assigned to the QSP Delegate(s).

The delegate cannot perform the QSD and QSP inspections required in Section V.C.4 or Section V.D.2, respectively.

Documentation of training activities will be retained in Appendix I.

## Section 6 Responsible Parties and Operators

### 6.1 RESPONSIBLE PARTIES

DAR(s) who are responsible for SWPPP implementation and have authority to sign permit-related documents are listed below. The DAR(s) assigned to this project are:

Name	Title	Phone Number
Darren Cousineau	LRP Signatory, District Director, Environmental Health and Risk Management	(559) 265-5745

QSD(s) identified for the project are identified in Appendix J. The QSD will have primary responsibility for assessing how construction activities will affect sediment transport, erosion, and other discharges of pollutants in stormwater runoff throughout the project. The QSD is required to revise the SWPPP to address potential problems identified by visual inspections, sampling data, comments from a QSP, or their own site observations. The QSD is required to perform the following on-site visual inspections:

- Within 30 days of construction activities commencing on site;
- Within 30 days when a new QSD is assigned to the project;
- Twice annually, once August through October and once January through March;
- Within 14 calendar days after a numeric action level exceedance; and
- Within the time period requested in writing from Regional Water Board staff.

QSPs and QSP Delegates identified for the project are identified in Appendix J. The QSP will have primary responsibility and significant authority for the implementation, maintenance, and inspection/monitoring of SWPPP requirements. The QSP will be available at all times throughout the duration of the project.

Duties of the QSP include but are not limited to:

- Implementing all elements of the 2022 CGP and SWPPP, including, but not limited to:
  - Performing the following on-site visual inspections:
    - One inspection per calendar month; other weekly inspections in the month can be delegated to a trained QSP Delegate under the specific direction of the QSP.
    - Within 72 hours prior to a forecasted qualifying precipitation event, to inspect any areas of concern and to verify the status of any deficient BMPs, or other identified issues at the site. If extended forecast precipitation data (greater than 72 hours) is available from the *National Weather Service*, then the Pre-Precipitation Event inspection may be done up to 120 hours in advance.
    - Within 14 days after a NAL exceedance, the QSP shall visually inspect the drainage area for exceedance and document any areas of concern.

- Prior to the submittal for the NOT or COI (for acreage changes) for all or part of the site.
- Ensuring that all BMPs are implemented, inspected, and properly maintained;
- Ensure that the SMARTS generated WDID Number Notification form is posted on-site, in a location viewable by the public or readily available upon request, and the dates are correct and match the dates listed in SMARTS.
- Implementing non-stormwater management, and materials and waste management activities such as: monitoring discharges; general Site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than stormwater are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems, etc.;
- Ensuring elimination of unauthorized discharges.
- The QSPs shall be assigned authority by the LRP to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate with the Contractor(s) to assure the necessary corrections/repairs are made immediately and that the project complies with the SWPPP, the 2022 CGP, and approved plans at all times.
- Notifying the LRP or Duly Authorized Representative immediately of off-site discharges or other non-compliance events.
- Providing foundation and site-specific training to QSP Delegates and overseeing QSP Delegate work. Tasks that may be delegated to appropriately trained QSP-delegates include:
  - Performing non-stormwater and stormwater visual observations and inspections;
  - Performing stormwater sampling and analysis, as required; and
  - Performing routine inspections and observations.

**Table 6-1. QSP and QSP Delegate Authorized Inspections**

	Weekly BMP and NSW	Pre-QPE	Daily-QPE Visual Inspections	Post-QPE Visual Inspections	Post NAL Exceedances	Monthly BMP and NSW	NOT
<b>QSP</b>	X	X	X	X	X	X	X
<b>QSP Delegate</b>	X		X	X			

## 6.2 CONTRACTOR LIST

Contractor Name:	TBD, Contractor information will be added via COI once known.
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	



## **Section 7 Construction Site Monitoring Program**

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### **7.1 Purpose**

This Construction Site Monitoring Program was developed to address the following objectives:

1. To demonstrate that the site is in compliance with the Discharge Prohibitions.
2. To determine whether non-visible pollutants discharged from the construction site and are causing or contributing to exceedances of water quality objectives;
3. To determine whether immediate corrective actions, additional BMP implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges;
4. To determine whether BMPs included in the SWPPP are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

### **7.2 Applicability of Permit Requirements**

This project has been determined to be a Risk Level 1 project. The 2022 CGP identifies the following types of monitoring as being applicable for a Risk Level 1 project.

Risk Level 1

- Visual inspections of BMPs;
- Visual monitoring of the site related to qualifying precipitation events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for non-visible pollutants identified during the pollutant source assessments when applicable; and
- Sampling and analysis of construction site runoff as required by the Regional Water Board when applicable.

### **7.3. Weather and Precipitation Event Tracking**

Visual monitoring and inspections requirements of the 2022 CGP are triggered by a Qualifying Precipitation Event. The 2022 CGP defines a Qualifying Precipitation Event as any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a Quantitative Precipitation Forecast (QPF) of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast.

#### **7.3.1 Weather Tracking**

The QSP should daily consult the National Oceanographic and Atmospheric Administration (NOAA) for the Forecast Weather Table Interface. These forecasts can be obtained at <http://forecast.weather.gov>. Weather reports should be printed and maintained with the SWPPP in Appendix M. Record the date and time the forecast was printed.

#### **7.3.2 Rain Gauges**

The QSP shall install a rain gauge on the project site. Locate the gauge in an open area away from obstructions such as trees or overhangs. Mount the gauge on a post at a height of 3 to 5 feet with the gauge extending several inches beyond the post. Make sure that the top of the

gauge is level. Make sure the post is not in an area where rainwater can indirectly splash from sheds, equipment, trailers, etc.

The rain gauge(s) shall be read daily during normal site scheduled hours by the Contractor. The rain gauge should be read at approximately the same time every day and the date and time of each reading recorded. An example rain gauge log sheet is provided in Appendix O. Retain rain gauge readings in Appendix N. Follow the rain gauge instructions to obtain accurate measurements.

Once the rain gauge reading has been recorded, accumulated rain shall be emptied, and the gauge reset.

For comparison with the site rain gauge, the nearest appropriate governmental rain gauge(s) is located at the staging area shown in Appendix A: Site Maps, Figures 2-4.

#### **7.4 Monitoring Locations**

Monitoring locations are shown on the Site Maps in Appendix A. Monitoring locations are described in the Sections 7.6 and 7.7.

Whenever changes in the construction site might affect the appropriateness of sampling locations, the sampling locations shall be revised accordingly. All such revisions shall be implemented as soon as feasible and the SWPPP amended. Temporary changes that result in a one-time additional sampling location do not require a SWPPP amendment.

#### **7.5 Safety and Monitoring Exemptions**

Safety practices for sample collection will be in accordance with the Contractor's Project health and safety plan. A summary of the safety requirements that apply to sampling personnel is provided below.

- Wear all required PPE at all times.
- Be careful of slips, trips, and falls during wet site conditions.

This project is not required to collect samples or conduct visual observations (inspections) under the following conditions (see Section III.B of the 2022 CGP):

- During dangerous weather conditions such as electrical storms, flooding, and high winds above 40 miles per hour;
- Outside of scheduled site operating hours; or

When the site is not accessible to personnel. Scheduled site business hours are: 7AM – 5PM, M-F

If monitoring (visual monitoring or sample collection) of the site is unsafe because of the dangerous conditions noted above, then the QSP shall document the conditions for why an exception to performing the monitoring was necessary. The exemption documentation will be filed in Appendix N and must be included in the Annual Report.

#### **7.6 Visual Monitoring**

Visual monitoring includes observations and inspections. Inspections of BMPs are required to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended. Visual observations of the site are required to observe storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.

Table 7-1 identifies the required frequency of visual observations and inspections. Inspections and observations will be conducted at the locations identified in Section 7.6.3.

**Table 7-1 Summary of Visual Monitoring and Inspections**

Type of Inspection	Frequency
<i>Routine Inspections<sup>1</sup></i>	
Site Entrances/Exits	Daily
Hazardous Material/Waste storage areas	Daily
BMP Inspections	Weekly <sup>2</sup>
<i>Qualifying Precipitation Event Triggered Inspections</i>	
Site Inspections Prior to a Qualifying Precipitation Event	Within 72 hours of a qualifying precipitation event or up to 120 hours prior if supported with forecast <sup>2</sup>
BMP Inspections During an Extended Qualifying Precipitation Event	Once every 24-hour period of a qualifying precipitation event <sup>3</sup>
Site Inspections Following a Qualifying Precipitation Event	Within 96 hours of a qualifying precipitation event <sup>2</sup>
<sup>1</sup> Inspections are required during scheduled site operating hours. <sup>2</sup> Most BMPs must be inspected weekly; those identified below must be inspected more frequently. <sup>3</sup> Inspections are required during scheduled site operating hours on days that the forecast predicts at least 0.25 inches of precipitation once the qualifying precipitation event commences.	

### **7.6.1 Routine Observations and Inspections**

Routine site inspections and visual monitoring are necessary to confirm that the project is in compliance with the requirements of the 2022 CGP.

#### **7.6.1.1 Routine BMP Inspections**

Inspections of BMPs are conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

#### **7.6.1.2 Non-Stormwater Discharge Observations**

Each drainage area will be inspected for the presence of or indications of prior unauthorized and authorized non-stormwater discharges. Inspections will record:

- Presence or evidence of any non-stormwater discharge (authorized or unauthorized);
- Identification and elimination of unauthorized non-stormwater discharges
- Pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.); and
- Source of discharge.

### **7.6.2      *Qualifying Precipitation Event Triggered Observations and Inspections***

Visual observations of the site and inspections of BMPs are required prior to a qualifying precipitation event; following a qualifying precipitation event, and every 24-hour period during a qualifying precipitation event. Pre-Qualifying Precipitation Event inspections will be conducted after consulting NOAA and determining that a precipitation event with a 50 percent or greater PoP and a QPF of 0.5 inches or more precipitation within a 24-hour period has been predicted by the National Weather Service Forecast Office.

#### **7.6.2.1      *Visual Observations Prior to a Forecasted Qualifying Precipitation Event***

Within 72 hours prior to a qualifying precipitation event or up to 120 hours prior if extended forecast precipitation data is available, a stormwater visual monitoring site inspection will include observations of the following locations:

- All stormwater drainage areas to identify leaks, spills, or uncontrolled pollutant sources and when necessary, implement appropriate corrective actions.
- All BMPs to identify whether they have been properly implemented per the SWPPP and implement appropriate corrective actions, as necessary.
- All stormwater storage and containment areas to detect leaks and check for available capacity to prevent overflow.

The QSP must conduct the inspection prior to the qualifying precipitation event. Consistent with the requirements for a qualifying precipitation event, pre-rain BMP inspections and visual monitoring will be triggered by a NOAA forecast that indicates a 50 percent or greater probability of 0.5 inches of precipitation or more in a 24-hour period in the project area.

#### **7.6.2.2      *BMP Inspections During a Qualifying Precipitation Event***

During an extended qualifying precipitation event BMP inspections will be conducted at least once every 24 hours. Qualifying precipitation events are extended for each subsequent 24-hour period forecast to have at least 0.25 inches of precipitation. The BMP inspections are to identify and record:

- If BMPs were adequately designed, implemented and effective.
- BMPs that require repair or replacement due to damage.
- Additional BMPs that need to be implemented and revise the SWPPP accordingly.

If the construction site is not accessible during the rain event, the visual inspections shall be performed at all relevant outfalls, discharge points, downstream locations. The inspections should record any projected maintenance activities.

#### **7.6.2.3      *Visual Observations Following a Qualifying Precipitation Event***

Within 96 hours following the end of a qualifying precipitation event a stormwater visual monitoring site inspection is required to observe:

- If BMPs were adequately designed, implemented and effective.
- BMPs that require repair or replacement due to damage.
- Additional BMPs that need to be implemented and revise the SWPPP accordingly.

### **7.6.3      *Visual Monitoring Procedures***

Visual monitoring shall be conducted by the QSP or QSP Delegates.

The name(s) and contact number(s) of the QSPs or QSP Delegates assigned to conduct visual observations are listed below and their training qualifications are provided in Appendix J.

Assigned QSP:	TBD. To be updated via COI	Phone #:
Assigned QSP Delegate:		Phone #:
Assigned QSP Delegate:		Phone #:

Stormwater observations shall be documented on the *Visual Inspection Field Log Sheet* (see Appendix O). BMP inspections shall be documented on the site-specific BMP inspection checklist and include photographs of areas of concern along with the QSP's description of the problem.

The QSP shall within 24 hours of the inspection submit copies of the completed inspection report to the Contractor.

The QSP shall be responsible for keeping a digital record of visual monitoring inspections, and shall provide their records to the QSD or Landowner upon request.

The completed reports will be kept in Appendix N. Results of visual monitoring must be summarized and reported in the Annual Report.

#### **7.6.4 Visual Monitoring Follow-Up and Reporting**

Maintenance, repairs, and correction of deficiencies, including design changes to BMPs, identified by the observations or inspections, including required repairs or maintenance of BMPs, shall be initiated within 72 hours of identification and completed as soon as possible, prior to the next forecasted precipitation event.

When design changes to BMPs are required, the SWPPP shall be amended to reflect the changes.

Deficiencies identified in site inspection reports and correction of deficiencies will be tracked on the *Inspection Field Log Sheet* or *BMP Inspection Report* shall be kept in Appendix N. QSP Delegates shall report issues identified during inspections that require corrective action to the QSP within 24 hours of the observation.

The QSP shall within 24 hours of the inspection submit copies of the completed *Inspection Field Log Sheet* or *BMP Inspection Report* with the corrective actions to the Contractor.

The QSP shall be responsible for keeping a digital record of visual monitoring inspections, and shall provide their records to the QSD or Landowner upon request.

Results of visual monitoring must be summarized and reported in the Annual Report.

#### **7.6.5 Visual Monitoring Locations**

The inspections and observations identified in Sections 7.6.1 and 7.6.2 will be conducted at the locations identified in this section.

BMP locations are shown on the Site Maps in Appendix A.

Due to grading activities and the installation of new surface or underground stormwater conveyance systems, the drainage areas of the Project site will change throughout construction. The SWPPP identifies two main conditions for pre-grading/pre-stormwater conveyance system construction and post-grading/stormwater conveyance system construction for the purposes of

identifying the main discharge locations of the Project for monitoring. These three main drainage conditions are presented in Site Maps in Appendix A.

The QSP and trained Delegates shall use the drainage conditions presented in Site Maps in Appendix A as a guide for understanding site drainage and then field verify the accurate drainage areas and discharge locations/sampling locations during the event of a release of a non-visible pollutant based on their observations of the current drainage conditions at the site.

For the pre-grading site condition, there are seven (7) drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) are shown on the Site Maps in Appendix A and Table 7-2 identifies each drainage area by location.

For the active earthwork site condition, there are six (6) drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) are shown on the Site Maps in Appendix A and Table 7-2 identifies each drainage area by location.

For the post-grading/post-stormwater system construction site condition, there are forty-six (46) drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) are shown on the Site Maps in Appendix A and Table 7-2 identifies each drainage area by location.

**Table 7-2 Site Drainage Areas**

<b>Pre-Grading Condition</b>	
<b>Location No.</b>	<b>Location</b>
DA 1	Vacant Lot
DA 2	Southwest Corner of Vacant Lot
DA 3	Northeast Parking Area
DA 4	Northeast Roadway
DA 5	Northeast Landscape Island
DA 6	North Roadway
DA 7	East and South Perimeters
<b>Earthwork Condition</b>	
DA 1	Vacant Lot
DA 2	Northeast Parking Area
DA 3	Northeast Roadway
DA 4	Northeast Landscape Island
DA 5	North Roadway
DA 6	East and South Perimeters
<b>Post-Grading/Post-Stormwater System Construction Condition</b>	
DA 1	Track – North End

DA 2	Track – Area 2
DA 3	Track – Area 3
DA 4	Track – Area 4
DA 5	Track – Area 5
DA 6	Track – Area 6
DA 7	Track – Area 7
DA 8	Track – Area 8
DA 9	Track – Area 9
DA 10	Track – Area 10
DA 11	Track – Area 11
DA 12	Track – Area 12
DA 13	Track – Area 13
DA 14	Track – Area 14
DA 15	Track – Area 15
DA 16	Track – Area 16
DA 17	Track – Area 17
DA 18	Track – Area 18
DA 19	Track – Area 19
DA 20	Track – Area 20
DA 21	Track – Area 21
DA 22	Track – Area 22
DA 23	Track – Area 23
DA 24	Track – Area 24
DA 25	Track – Area 25
DA 26	Track – Area 26
DA 27	Northwest Turf Area
DA 28	North Stadium – Area 1
DA 29	North Stadium – Area 2
DA 30	North Stadium – Area 3
DA 31	Staging Area
DA 32	North Stadium – Area 4
DA 33	Ticket Booth – NWC
DA 34	Ticket Booth – NEC
DA 35	Ticket Booth – SWC

DA 36	Northeast Landscape Island
DA 37	Northeast Roadway
DA 38	Northeast Parking Area
DA 39	Ticket Booth – SEC
DA 40	Jump Pit 1
DA 41	Jump Pit 2
DA 42	Jump Pit 3
DA 43	Jump Pit 4
DA 44	South Perimeter
DA 45	Pole Vault Area
DA 46	West Turf Area

There are expected to be one (1) stormwater storage or containment area(s) are on the project site from which stormwater may be dewatered. Stormwater storage or containment area(s) are shown on the Site Maps in Appendix A and Table 7-3 identifies each stormwater storage or containment area by location.

**Table 7-3 Stormwater Storage and Containment Areas (Dewatering Locations)**

Location No.	Location
CA 1	Vacant Lot

For the pre-grading/pre-stormwater system construction site condition, there are six (6) discharge location(s) on the project site. Site stormwater discharge location(s) are shown on the Site Maps in Appendix A and Table 7-4 identifies each stormwater discharge location.

For the Earthwork and post-earthwork condition, there are five (5) discharge location(s) on the project site. Site stormwater discharge location(s) are shown on the Site Maps in Appendix A and Table 7-4 identifies each stormwater discharge location.

For the post-grading/post-stormwater system construction site condition, there are forty-six (46) discharge location(s) on the project site. Site stormwater discharge location(s) are shown on the Site Maps in Appendix A and Table 7-4 identifies each stormwater discharge location.

**Table 7-4 Site Stormwater Discharge Locations**

Pre-Grading Construction Condition	
Location No.	Location
SL 2	Southwest Corner of Vacant Lot storm drain



SL 3	Northeast Parking Area storm drain
SL 4	Northeast Roadway storm drain
SL 5	Northeast Landscape Island storm drain
SL 6	North Roadway storm drain
SL 7	East and South Perimeter edge of disturbed area
<b>Earthwork Condition</b>	
SL 2	Northeast Parking Area storm drain
SL 3	Northeast Roadway storm drain
SL 4	Northeast Landscape Island storm drain
SL 5	North Roadway storm drain
SL 6	East and South Perimeters edge of disturbed area
<b>Post-Grading/Post-Stormwater System Construction Condition</b>	
SL 1	Track – North End trench drain
SL 2	Track – Area 2 storm drain
SL 3	Track – Area 3 storm drain
SL 4	Track – Area 4 storm drain
SL 5	Track – Area 5 storm drain
SL 6	Track – Area 6 storm drain
SL 7	Track – Area 7 storm drain
SL 8	Track – Area 8 storm drain
SL 9	Track – Area 9 storm drain
SL 10	Track – Area 10 storm drain
SL 11	Track – Area 11 storm drain
SL 12	Track – Area 12 storm drain
SL 13	Track – Area 13 storm drain
SL 14	Track – Area 14 storm drain
SL 15	Track – Area 15 storm drain
SL 16	Track – Area 16 storm drain
SL 17	Track – Area 17 storm drain
SL 18	Track – Area 18 storm drain
SL 19	Track – Area 19 storm drain
SL 20	Track – Area 20 storm drain
SL 21	Track – Area 21 storm drain
SL 22	Track – Area 22 storm drain

SL 23	Track – Area 23 storm drain
SL 24	Track – Area 24 storm drain
SL 25	Track – Area 25 storm drain
SL 26	Track – Area 26 storm drain
SL 27	Northwest Turf Area storm drain
SL 28	North Stadium – Area 1 storm drain
SL 29	North Stadium – Area 2 storm drain
SL 30	North Stadium – Area 3 storm drain
SL 31	Gutter to the east of the staging area, before new concrete area
SL 32	North Stadium – Area 4 storm drain
SL 33	Ticket Booth – NWC trench drain
SL 34	Ticket Booth – NEC storm drain
SL 35	Ticket Booth – SWC trench drain
SL 36	Northeast Landscape Island storm drain
SL 37	Northeast Roadway storm drain
SL 38	Northeast Parking Area storm drain
SL 39	Ticket Booth – SEC edge of newly developed area and existing sidewalk
SL 40	Jump Pit 1 storm drain
SL 41	Jump Pit 2 storm drain
SL 42	Jump Pit 3 storm drain
SL 43	Jump Pit 4 storm drain
SL 44	South Perimeter edge of newly developed area and existing sidewalk
SL 45	Pole Vault Area storm drain
SL 46	West Turf Area storm drain

## 7.7 Sampling and Analysis Plan for Non-Visible Pollutants in Stormwater Runoff Discharges

This Sampling and Analysis Plan for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in stormwater runoff discharges from the project site.

Sampling for non-visible pollutants, including those associated with TMDLs, will be conducted when (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.

The QSP and trained Delegates are responsible for completing the following non-visible pollutant monitoring requirements:

- The QSP and trained Delegates shall collect one or more samples during any breach, malfunction, leakage, or spill observed during a visual inspection which could result in the discharge of pollutants to surface waters that would be visually detectable in storm water;
- The QSP and trained Delegates is not required to sample if one of the conditions described above (e.g., breach or spill) occurs and the site is cleaned of material and pollutants and/or BMPs are implemented prior to the next storm event;
- The QSP and trained Delegates shall ensure that water samples are large enough to characterize the site conditions;
- The QSP and trained Delegates shall collect samples at all discharge locations that can be safely accessed;
- The QSP and trained Delegates shall collect samples during the first two hours of discharge from rain events that occur during business hours which generate runoff;
- The QSP and trained Delegates shall analyze samples for the non-visible pollutant parameters, if applicable (see the list of parameters identified in Table 7-5 – Potential Non-Visible Pollutants and Water Quality Indicator Constituents Based on the Pollutant Source Assessment);
- The QSP and trained Delegates shall collect a sample of storm water that has not come in contact with the disturbed soil or materials stored or used onsite (uncontaminated sample) for comparison with the discharge sample;
- The QSP and trained Delegates shall compare the uncontaminated sample to the samples of discharge using field analysis or through laboratory analysis;
- For laboratory analyses, all sampling sample preservation, and other analyses must be conducted according to test procedures pursuant to 40 C.F.R. Part 136. SCE shall ensure that field samples are collected and analyzed according to manufacturer specifications of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specifications; and
- The QSP and trained Delegates shall keep all field/or analytical data with the SWPPP document.

Table 7-5 summarizes the potential non-visible pollutants identified in the pollutant source assessment Sections 2.6 and 2.7 and the water quality constituent or indicator for that pollutant. Drainage areas for the pre-grading/pre-stormwater system construction and post-grading/post-stormwater system construction site conditions where the source is present are identified in Table 7-6 and shown in the Site Maps in Appendix A.

**Table 7-5 Potential Non-Visible Pollutants and Water Quality Indicator Constituents Based on the Pollutant Source Assessment**

Pollutant	Water Quality Indicator or Constituent	Source/Reason from Pollutant Source Assessment	TMDL Pollutant	Pre-Grading Site Drainage Area	Earth-work Site Drainage Area	Post-Grading Site Drainage Area
PCBs (from demolished structures from 1950-1980)	PCBs	Building Demolition	No	None	None	None
Lead Paint	Pb	Building Demolition	No	None	None	None
Gypsum / Lime amendments	pH	Grading / Earthwork	No	None	All	None
Contaminated soil	Constituents specific to known contaminants, check with Laboratory	Grading / Earthwork	No	None	None	None
Sealant (Methyl methacrylate)	SVOC	Concrete Masonry Work	No	None	None	All
Curing compounds	VOCs, SVOCs, pH	Concrete Masonry Work	No	None	None	All
Ash, slag, sand	pH, Al, Ca, Va, Zn	Concrete Masonry Work	No	None	None	All
Treated Wood	Cu, CR, As, Zn	Carpentry Work	No	None	None	33, 34, 35, 39
Particle Board	Formaldehyde	Carpentry Work	No	None	None	33, 34, 35, 39
Untreated Wood	BOD	Carpentry Work	No	None	None	33, 34, 35, 39
Drywall	Cu, Al, CA, VA, Zn	Building Construction	No	None	None	33, 34, 35, 39
Solder, flux, pipe fitting	Cu, Pb, Sn, Sn	Plumbing	No	None	None	33, 34, 35, 39
Roofing Compound	Cu, Pb, VOC	Roofing	No	None	None	33, 34, 35, 39
Insulation	Al, Zn	Insulation	No	None	None	33, 34, 35, 39
Resins, Thinners, Paint Strippers, Lacquers, varnishes, enamels, Sealants, Adhesives	COD, SVOCs, VOCs, Metals, Phenols	Painting	No	None	None	33, 34, 35, 39
Chlorinated water	Residual Chlorine, Chloramines	Utility Line Testing and Flushing	No	All	All	All
Pesticides/ Herbicides	Product dependent, see label and check with Laboratory	Vegetation Management	No	None	None	All
Vegetation Stockpiles	BOD	Vegetation Management	No	1	1	31
Fertilizers	TKN, NO <sub>3</sub> , BOD, COD,	Landscaping	No	None	None	All

**Table 7-5 Potential Non-Visible Pollutants and Water Quality Indicator Constituents Based on the Pollutant Source Assessment**

Pollutant	Water Quality Indicator or Constituent	Source/Reason from Pollutant Source Assessment	TMDL Pollutant	Pre-Grading Site Drainage Area	Earth-work Site Drainage Area	Post-Grading Site Drainage Area
	DOC, Sulfate, NH <sub>3</sub> , Phosphate Potassium					
Aluminum Sulfate	AL, TDS, Sulfate	Landscaping/soil amendments	No	None	1, 5, 6	None
Liquid Waste	Constituents specific to materials, check with Laboratory	Liquid Waste	No	All	All	All
Sewer line breaks and Portable Toilets	BOD, Total/Fecal coliform	Sanitary Waste	No	1	1, 5	34
Polymer/Co-polymers	TKN, NO <sub>3</sub> , BOD, COD, DOC, Sulfate, Ni	Soil Preparation / Amendments / Dust Control	No	None	1, 5, 6	None
Lignin sulfate	TDS, Alkalinity	Soil Amendments/ Dust Control	No	None	1, 5, 6	None
Psyllium	COD, TOC	Soil Amendments/ Dust Control	No	None	1, 5, 6	None
Guar/Plant Gums	COD, TOC, Ni	Soil Amendments/ Dust Control	No	None	1, 5, 6	None
Batteries	Sulfuric Acid, Pb, pH	Vehicle and Equipment Use	No	All	All	All
Freon	Freon	Heating, Ventilation, Air Conditions	No	All	All	All

### 7.7.1 Sampling Schedule

Samples for the potential non-visible pollutant(s) and a sufficiently large unaffected background sample shall be collected during the first eight hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during the site's scheduled hours and shall be collected regardless of the time of year and phase of the construction.

Collection of discharge samples for non-visible pollutant monitoring will be triggered only when any of the following conditions are observed during site inspections conducted prior to or during a rain event.

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents stormwater contact and runoff from the storage area.

- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- A construction activity, including but not limited to those in Section 2.6, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Stormwater runoff from an area contaminated by historical usage of the site has been observed to combine with stormwater runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.

### **7.7.2 Sampling Locations**

Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use, accessibility for sampling, and personnel safety. Planned non-visible pollutant sampling locations are shown on the Site Maps in Appendix A and include the locations identified in Table 7-6.

#### **Pre-grading site condition:**

Zero (0) sampling location(s) on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Zero (0) sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Zero (0) sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Zero (0) sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. These locations will be selected in the field by the QSP such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

Two (2) sampling locations have been identified for the collection of samples of run-on to the project site. Run-on from these locations has the potential to combine with discharges from the site being sampled for non-visible pollutants. These samples are intended to identify potential sources of non-visible pollutants that originate off the project site.

#### **Earthwork construction site condition:**

Zero (0) sampling location(s) on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Two (2) sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Zero (0) sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Zero (0) sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. These locations will be selected in the field by the QSP such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

Two (2) sampling locations have been identified for the collection of samples of run-on to the project site. Run-on from these locations has the potential to combine with discharges from the site being sampled for non-visible pollutants. These samples are intended to identify potential sources of non-visible pollutants that originate off the project site.

Post-grading/Post-stormwater system construction site condition:

One (1) sampling location(s) on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Zero (0) sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Zero (0) sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Zero (0) sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. These locations will be selected in the field by the QSP such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

Two (2) sampling locations have been identified for the collection of samples of run-on to the project site. Run-on from these locations has the potential to combine with discharges from the site being sampled for non-visible pollutants. These samples are intended to identify potential sources of non-visible pollutants that originate off the project site.

**Table 7-6 Non-Visible Pollutant Sample Locations**

Pre-Grading Construction Condition			
Sample Location Identifier	Sample Location Description	Sample Location Latitude and Longitude (Decimal Degrees)	Runoff or Run-on
SL 2	Southwest Corner of Vacant Lot storm drain	36.881843, -119.734164	Runoff

SL 3	Northeast Parking Area storm drain	36.883516, -119.732662	Runoff
SL 4	Northeast Roadway storm drain	36.883443, -119.732640	Runoff
CS 4	The gutter upstream of northeast roadway storm drain	36.883705, -119.732307	Run-on
SL 5	Northeast Landscape Island storm drain	36.883323, -119.732790	Runoff
SL 6	North Roadway storm drain	36.882933, -119.732946	Runoff
CS 6	The gutter upstream of the north roadway storm drain	36.883405, -119.732962	Run-on
SL 7	East and South Perimeter edge of disturbed area	36.881530, -119.733777	Runoff
<b>Earthwork Construction Condition</b>			
<b>Sample Location Identifier</b>	<b>Sample Location Description</b>	<b>Sample Location Latitude and Longitude (Decimal Degrees)</b>	<b>Runoff or Run-on</b>
SL 2	Northeast Parking Area storm drain	36.883516, -119.732662	Runoff
SL 3	Northeast Roadway storm drain	36.883443, -119.732640	Runoff
CS 3	The gutter upstream of the northeast roadway storm drain	36.883705, -119.732307	Run-on
SL 4	Northeast Landscape Island storm drain	36.883323, -119.732790	Runoff
SL 5	North Roadway storm drain	36.882933, -119.732946	Runoff
CS 5	The gutter upstream of the north roadway storm drain	36.883405, -119.732962	Run-on
SL 6	East and South Perimeters edge of disturbed area	36.881530, -119.733777	Runoff
<b>Post-Grading/Post-Stormwater System Construction Condition</b>			
<b>Sample Location Identifier</b>	<b>Sample Location Description</b>	<b>Sample Location Latitude and Longitude (Decimal Degrees)</b>	<b>Runoff or Run-on</b>
SL 1	Track – North End trench drain	36.883144, -119.733780	Runoff
SL 2	Track – Area 2 storm drain	36.882841, -119.734251	Runoff
SL 3	Track – Area 3 storm drain	36.882865, -119.733458	Runoff
SL 4	Track – Area 4 storm drain	36.882719, -119.734262	Runoff
SL 5	Track – Area 5 storm drain	36.882753, -119.733462	Runoff
SL 6	Track – Area 6 storm drain	36.882598, -119.734266	Runoff



SL 7	Track – Area 7 storm drain	36.882650, -119.733477	Runoff
SL 8	Track – Area 8 storm drain	36.882501, -119.734254	Runoff
SL 9	Track – Area 9 storm drain	36.882565, -119.733484	Runoff
SL 10	Track – Area 10 storm drain	36.882516, -119.734163	Runoff
SL 11	Track – Area 11 storm drain	36.882519, -119.733541	Runoff
SL 12	Track – Area 12 storm drain	36.882407, -119.734190	Runoff
SL 13	Track – Area 13 storm drain	36.882410, -119.733511	Runoff
SL 14	Track – Area 14 storm drain	36.882322, -119.734239	Runoff
SL 15	Track – Area 15 storm drain	36.882152, -119.733469	Runoff
SL 16	Track – Area 16 storm drain	36.881991, -119.734266	Runoff
SL 17	Track – Area 17 storm drain	36.881994, -119.733473	Runoff
SL 18	Track – Area 18 storm drain	36.881888, -119.734216	Runoff
SL 19	Track – Area 19 storm drain	36.881885, -119.733443	Runoff
SL 20	Track – Area 20 storm drain	36.881879, -119.734194	Runoff
SL 21	Track – Area 21 storm drain	36.881882, -119.733431	Runoff
SL 22	Track – Area 22 storm drain	36.881782, -119.734141	Runoff
SL 23	Track – Area 23 storm drain	36.881727, -119.733981	Runoff
SL 24	Track – Area 24 storm drain	36.881697, -119.733795	Runoff
SL 25	Track – Area 25 storm drain	36.881758, -119.733632	Runoff
SL 26	Track – Area 26 storm drain	36.881855, -119.733405	Runoff
SL 27	Northwest Turf Area storm drain	36.882853, -119.734466	Runoff
SL 28	North Stadium – Area 1 storm drain	36.883203, -119.734173	Runoff
SL 29	North Stadium – Area 2 storm drain	36.883261, -119.733938	Runoff
SL 30	North Stadium – Area 3 storm drain	36.883257, -119.733713	Runoff
SL 31	Gutter to the east of the staging area, before new concrete area	36.883398, -119.732964	Runoff
CS 31	In the gutter, upstream of the staging area	36.883676, -119.732964	Run-on
SL 32	North Stadium – Area 4 storm drain	36.883196, -119.733428	Runoff
SL 33	Ticket Booth – NWC trench drain	36.883091, -119.733343	Runoff
SL 34	Ticket Booth – NEC storm drain	36.882929, -119.732941	Runoff
SL 35	Ticket Booth – SWC trench drain	36.882828, -119.733253	Runoff
SL 36	Northeast Landscape Island storm drain	36.883318, -119.732801	Runoff
SL 37	Northeast Roadway storm drain	36.883481, -119.732621	Runoff

CS 37	In the gutter, upstream of the northeast roadway storm drain	36.883719, -119.732305	Run-on
SL 38	Northeast Parking Area storm drain	36.883538, -119.732653	Runoff
SL 39	Ticket Booth – SEC edge of newly developed area and existing sidewalk	36.882600, -119.732950	Runoff
SL 40	Jump Pit 1 storm drain	36.882185, -119.733149	Runoff
SL 41	Jump Pit 2 storm drain	36.882193, -119.733054	Runoff
SL 42	Jump Pit 3 storm drain	36.881684, -119.733126	Runoff
SL 43	Jump Pit 4 storm drain	36.881691, -119.733050	Runoff
SL 44	South Perimeter edge of newly developed area and existing sidewalk	36.881525, -119.733613	Runoff
SL 45	Pole Vault Area storm drain	36.882160, -119.734457	Runoff
SL 46	West Turf Area storm drain	36.882658, -119.734480	Runoff

If a stormwater visual monitoring site inspection conducted prior to or during a storm event identifies the presence of a material storage, waste storage, operations area with spills, or the potential for the discharge of non-visible pollutants to surface waters or a storm drain system that is at a location not listed above and has not been identified on the Site Maps, sampling locations will be selected by the QSP using the same rationale as that used to identify planned locations. Non-visible pollutant sampling locations shall be documented by the QSP on the pre-rain event inspection form prior to a forecasted qualifying precipitation event and the *Effluent Sampling Field Log Sheet*, which are provided in Appendix O.

### 7.7.3 Monitoring Preparation

Non-visible pollutant samples will be collected by:

QSP ☒ Yes ☐ No

QSP Delegate ☒ Yes ☐ No

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with rain or direct sunlight. The QSP or QSP Delegates responsible for sampling will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, clean powder-free nitrile gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, ice, and *Effluent Sampling Field Log Sheets* and Chain of Custody (CoC) forms, which are provided in Appendix O.

#### 7.7.3.1 Analytical Constituents

Table 7-7 lists the specific sources and types of potential non-visible pollutants based on the project pollutant source assessment and the water quality indicator constituent(s) for that pollutant. Table 7-7 provides the specific analytical methods and reporting limits for the potential non-visible pollutants. Analytical methods were selected in compliance with U.S. EPA

sufficiently sensitive method requirements in 40 Code of Federal Regulations Part 136, as evidenced by the method detection limit and minimum level.

#### **7.7.4 Sample Collection**

Samples of discharge shall be collected at the designated non-visible pollutant sampling locations identified in Table 7-6 and shown on the Site Maps in Appendix A or in the locations determined by observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event.

Only the QSP, or QSP Delegates trained on sample collection identified in Section 7.7.1.3 shall collect samples. Grab samples will be collected and preserved in accordance with the methods identified in Table 7-7. Samples will be collected by following the steps outlined below:

1. Place a laboratory provided sampling container directly into a stream of water down-gradient and within close proximity to the potential non-visible pollutant discharge location;
2. Transfer the collected sample into the sample bottles (supplied by the lab for the appropriate parameters being monitored) filling the bottles completely (or as instructed by the laboratory);
3. The up-gradient (uncontaminated) background samples will be collected first, prior to collecting the down-gradient sample, in order to minimize cross-contamination; and
4. Sampling personnel will collect the water up-gradient of where they are standing.

To maintain sample integrity and prevent cross-contamination, sampling collection personnel will:

- Wear a clean pair of powder-free nitrile gloves prior to the collection and handling of each sample at each location;
- Not contaminate the inside of the sample bottle by allowing it to come into contact with any material other than the water sample;
- Discard sample bottles or sample lids that have been dropped onto the ground prior to sample collection;
- Not leave the cooler lid open for an extended period of time once samples are placed inside;
- Not sample near a running vehicle where exhaust fumes may impact the sample;
- Not touch the exposed end of a sampling tube, if applicable;
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles;
- Not eat, smoke, or drink during sample collection nor sneeze or cough in the direction of an open sample bottle;
- Minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample;
- Decontaminate sampling equipment prior to sample collection using a tri-sodium phosphate (TSP) solution water wash and triple rinse with distilled or de-ionized water; and
- Dispose of decontamination water/soaps appropriately (i.e., do not discharge to the storm drain system or receiving water).

Note, that depending upon the specific analytical test, some containers may contain preservatives. These containers should **never** be dipped into the stream but filled indirectly from the collection container.

#### *7.7.4.1 Clean Sampling Techniques*

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. As discussed in Section 7.7.7, adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

**Table 7-7 Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants**

Constituent	Analytical Method	Minimum Sample Volume	Sample Containers	Sample Preservation	Reporting Limit	Maximum Holding Time
SVOCs	EPA 625	1 x 1 L	Glass-amber	Store at 4°C	10 ug/L	7 days
VOCs	EPA 601/602	3 X 40 mL	VOA - Glass	Store at 4°C, HCL to pH<2	1 ug/L	14 days
BOD	EPA 405.1	1 x 500 mL	Polypropylene	Store at 4°C	1 mg/L	48 hours
COD	EPA 410.4	1 X 250mL	Glass - Amber	Store at 4°C, H2SO4 to pH<2	5 mg/L	28 days
DO	SM 4500-OG	1 x 250 mL	Glass-Amber	Store at 4°C	Check Lab	8 hours
NO3	EPA 353.2	1 x 250 mL	Glass-Amber	Store at 4°C, H2SO4	0.05 mg/L	28 days
NH3	EPA 350.1	1 x 250 mL	Glass-Amber	Store at 4°C, H2SO4	0.01 mg/L	
TKN	EPA 351.1	1 x 250 mL	Glass-Amber	Store at 4°C, H2SO4 to pH<2	0.1 mg/L	28 days
Coliform, Fecal	FDA BAM CH 4	1 x 100 mL	Glass/Polypropylene	Store at or below 10°C	0.1 mg/L	8 hours
Coliform, Total	SM 9221B	1 x 100 mL	Glass/Polypropylene	Store at or below 10°C	0.1 mg/L	8 hours
Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Se, Na, Th, Va, Zn)	EPA 200.8/1631	1 x 250 mL	Polypropylene	Store at 4°C, HNO3 to pH<2	0.1 mg/L	6 months
Chromium VI	EPA 7196	1 x 500 mL	Polypropylene	Store at 4°C	1 g/L	24 hours
Ortho Phenyl Phenol	HPLC FLUORESCENCE	1 x 1L	Tenax GC Tube	Store at 4°C	1 mg/L	8 hours
pH	SM 4500B	1 x 100 mL	Polypropylene	None	Unit less	15 minutes
Formaldehyde	EPA 1667A	1 x 20 mL	Glass-Amber	Store at 4°C	50 ug/L	5 days
PCBs	EPA 608	1 x 1 L	Glass-Amber	Store at 4°C, H2SO4 to pH 5-9	0.25 ug/L	40 days

### 7.7.5 **Sample Analysis**

Samples shall be analyzed using the analytical methods identified in the Table 7-7.

Samples will be analyzed by:

Laboratory Name: BSK Associates – Fresno  
Street Address: 1414 Stanislaus St,  
City, State Zip: Fresno, CA 93706  
Telephone Number: (559) 497-2888  
Point of Contact: TBD  
ELAP Certification Number: 01180CA

Samples will be delivered to the laboratory by:

Driven by QSP/QSP Delegate/Contractor	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Picked up by Laboratory Courier	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Shipped	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

### 7.7.6 **Sample Handling**

All samples for laboratory analysis must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Place samples to be shipped inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The 2022 CGP requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless required sooner by the analytical laboratory to meet all hold times).

### 7.7.7 **Sample Documentation Procedures**

All original data documented on sample container identification labels, *Effluent Sampling Field Log Sheet* (Appendix O), and CoCs shall be recorded using waterproof ink. These shall be considered accountable documents. If an error is made on an accountable document, the individual shall make corrections by lining through the error and entering the correct information. The erroneous information shall not be obliterated. All corrections shall be initialed and dated.

Duplicate samples shall be identified consistent with the numbering system for other samples to prevent the laboratory from identifying duplicate samples. Duplicate samples shall be identified in the Effluent Sampling Field Log Sheet.

Sample documentation procedures include the following:

Sample Bottle Identification Labels: Sampling personnel shall attach an identification label to each sample bottle. Sample identification shall uniquely identify each sample location. (These location identifiers should be listed in the tables in the SWPPP.)

**Field Log Sheets:** Sampling personnel shall complete the *Effluent Sampling Field Log Sheet* and *Receiving Water Sampling Field Log Sheet* (Appendix O) for each sampling event, as appropriate.

**Chain of Custody:** Sampling personnel shall complete the CoC for each sampling event for which samples are collected for laboratory analysis. The sampler will sign the CoC (Appendix O) when the sample(s) is turned over to the testing laboratory or courier.

### **7.7.8 QA/QC Samples**

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods. The following types of QA/QC will be conducted for this project:

- ☒ Field Duplicates at a frequency of 5 percent or 1 duplicate minimum per sampling event (Required for all sampling plans with field measurements or laboratory analysis)
- ☐ Equipment Blanks  
(Only needed if the equipment used to collect samples could add the pollutants to sample)
- ☒ Field Blanks  
(Only required if sampling method calls for field blanks)
- ☒ Travel Blanks  
(Required for sampling plans that include VOC laboratory analysis)

#### **7.7.8.1 Field Duplicates**

Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples shall be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected shall be randomly selected from the discharge locations. Duplicate samples shall be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time as possible to the original sample. Duplicate samples shall not influence any evaluations or conclusion.

#### **7.7.8.2 Equipment Blanks**

Equipment blanks provide verification that equipment has not introduced a pollutant into the sample. Equipment blanks are typically collected when:

- New equipment is used;
- Equipment that has been cleaned after use at a contaminated site;
- Equipment that is not dedicated for surface water sampling is used; or
- Whenever a new lot of filters is used when sampling metals.

#### **7.7.8.3 Field Blanks**

Field blanks assess potential sample contamination levels that occur during field sampling activities. De-ionized water field blanks are taken to the field, transferred to the appropriate container, and treated the same as the corresponding sample type during the course of a sampling event.

#### 7.7.8.4 *Travel Blanks*

Travel blanks assess the potential for cross-contamination of volatile constituents between sample containers during shipment from the field to the laboratory. De-ionized water blanks are taken along for the trip and held unopened in the same cooler with the VOC samples.

### 7.7.9 **Quality Assurance and Quality Control**

An effective Quality Assurance and Quality Control (QA/QC) plan shall be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- CoCs;
- QA/QC Samples; and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

#### 7.7.10 ***Chain of Custody***

The sample CoC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample CoC procedures include the following:

- Proper labeling of samples;
- Use of CoC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide CoC forms to be filled out for sample containers. An example CoC is included in Appendix O.

#### 7.7.11 ***Data Verification***

After results are received from the analytical laboratory, the QSP or QSP Delegates shall verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Data verification shall include:

- Check the CoC and laboratory reports.  
*Make sure all requested analyses were performed and all samples are accounted for in the reports.*
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values and follow up with the laboratory.  
*Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. The QSP or QSP Delegates should especially note data that is an order of magnitude or more different than similar locations or is inconsistent with previous data from the same location.*
- Check laboratory QA/QC results.  
*EPA establishes QA/QC checks and acceptable criteria for laboratory analyses. These data are typically reported along with the sample results. The QSP or QSP Delegates shall evaluate the reported QA/QC data to check for contamination (method, field, and*



*equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.*

- Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate.  
*Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met and confirms this in writing.*

Field data including inspections and observations must be verified as soon as the field logs are received, typically at the end of the sampling event. Field data verification shall include:

- Check field logs to make sure all required measurements were completed and appropriately documented;
- Check reported values that appear out of the typical range or inconsistent; Follow-up immediately to identify potential reporting or equipment problems, if appropriate, recalibrate equipment after sampling;
- Verify equipment calibrations;
- Review observations noted on the field logs; and
- Review notations of any errors and actions taken to correct the equipment or recording errors.

#### **7.7.12 Data Evaluation and Reporting**

The QSP shall complete an evaluation of the water quality sample analytical results based on a comparison of the results to the unaffected sample.

Runoff/downgradient results shall be compared with the associated upgradient/unaffected results and any associated run-on results. Should the runoff/downgradient sample show an increased level of the tested analyte relative to the unaffected background sample, which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences shall be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs shall be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs shall be recorded as an amendment to the SWPPP.

##### **The QSP is responsible for reporting:**

- Analytical results of non-visible pollutant monitoring shall be submitted to the QSD within 5 days of obtaining the analytical results.

##### **The QSD is responsible for reporting:**

- Analytical results of non-visible pollutant monitoring shall be submitted to SMARTS by the QSD within 10 days of obtaining the analytical results.

The 2022 CGP prohibits the storm water discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4. The results of any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the Regional Water Board and other agencies as required by 40 C.F.R. §§ 117.3 and 302.4.

## 7.8 Sampling and Analysis Plan for Dewatering Discharges

Dewatering activities associated with this project *are not* subject to a separate NPDES permit and will be discharged under this WDID. Dewatering discharges authorized include mechanical pumping or syphoning of non-potable water from sources including, but not limited to: groundwater removal specifically related to the construction activities from excavations, trenches, foundations, vaults, **and/or** stormwater collected in impoundments (e.g., trenches, ponds, puddles, low points on the active site, or other similar accumulation points).

### Dewatering Activities for the Project Site:

- ☐ No dewatering activities are planned for this project.
- ☐ Dewatering activities planned for this project will be conducted and monitored according to the requirements of the following NPDES Permit: [insert name and order number of the permit.]
- ☒ Dewatering activities may occur for this project and will be conducted and monitored according to the requirements of the 2022 CGP Attachment J.

This Sampling and Analysis Plan for dewatering discharges describes the sampling and analysis strategy and schedule for monitoring dewatering discharges in accordance with the requirements of the 2022 CGP.

Dewatering of non-stormwater or non-groundwater sources (other than de-chlorinated potable water) is prohibited. Dewatering of stormwater with presence of an oily sheen, odor, or discoloration is prohibited. Dewatering of stormwater that is suspected to have contacted non-visible pollutants due to a spill, breach, or malfunction shall also be sampled for non-visible pollutants according to Section 7.7 of this SWPPP.

### **7.8.1 Dewatering Reporting Requirements**

At least 24 hours prior to the beginning of a dewatering discharge, the QSP or trained Delegates shall notify the applicable Regional Water Board stormwater and local MS4 staff (i.e., the Fresno Metropolitan Flood Control District) via email of the anticipated dewatering discharge, and copy the LRP and QSD.

The Project QSP will update the field SWPPP at least 24 hours prior to the beginning of a dewatering discharge. The Project QSD will upload a formal COI with the amended SWPPP, to SMARTS within 14 days. The SWPPP will be amendment to include all requirements established in Attachment J, Section D.4 of the 2022 CGP.

### **7.8.2 Dewatering Numeric Action Levels (NALs)**

Dewatering activities covered by the CGP are subject to the pH and turbidity NALs in Table 7-8 below. A NAL exceedance occurs when a single sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-8. Dewatering sampling is to be performed within the first hour of commencement of discharge and daily each day that the discharge continues.

**Table 7-8: Dewatering Numeric Action Levels (NALs)**

Parameter	Unit	Numeric Action Levels
pH	pH units	Lower NAL < 6.5, Upper NAL > 8.5
Turbidity	NTU	>250 NTU

If a pH or Turbidity exceedance occurs, dewatering activities will **cease immediately** until either: (1) enough time and dry weather has allowed sediment in stored water to settle or pH to neutralize, as advised by the QSP (2) additional BMPs have been implemented to prevent the NAL exceedance.

If a pH or Turbidity exceedance occurs, within five (5) calendar days, the project QSP will investigate the cause of the exceedance and identify corrective actions and notify the QSD and LRP. Within ten (10) days, the QSD will enter field measurements demonstrating the exceedance into SMARTS. If necessary, the QSD will revise the SWPPP to incorporate immediate corrective actions to prevent further exceedances of the numeric action levels for pH and turbidity.

### ***7.8.3 Dewatering Schedule***

As of the initial draft of this SWPPP there are no planned dewatering activities for the Project. The need for dewatering from the Project site may arise based on impoundment of low points in the Project site and a desire by the Contractor to continue construction activities in impounded areas.

If dewatering activities that result in discharge off-site are planned to commence, dewatering activities and sample analysis shall comply with this Section 7.8.

### ***7.8.4 Dewatering Locations and Discharge Locations, and Sampling Locations***

If the Contractor desires to pump or siphon impounded stormwater at the Project site, the QSP and trained Delegates shall first consider if on-site pervious areas could be utilized for on-site stormwater storage and percolation (without resulting in discharging off-site) rather than discharging impounded stormwater off-site. This moving of stormwater throughout the site is not considered dewatering and therefore does not require the reporting or sampling requirements outlined in this Section 7.8.

Since the need for dewatering operations are dependent on minor changes to the construction schedule and future precipitation events, the dewatering locations, discharge locations, and sampling locations are unknown as of the initial authoring of this SWPPP. If the Contractor/QSP identifies planned dewatering activities, the field copy of Site Maps in Appendix A and Table 7-9 will be updated by the QSP or Trained Delegates with dewatering locations, discharge locations, and sampling locations prior to starting dewatering operations.

Dewatering discharge locations shall be selected to prevent dewatering discharge from contacting construction materials and equipment. Outlet locations are prohibited from using waters of the United States as part of the treatment area for all areas or points where dewatering is discharged. Velocity reduction BMPs/devices shall be implemented to prevent scour down-gradient from the outlet location. Sampling locations will represent the water quality of dewatering water as it leaves the Project site.

The QSP shall notify the QSD and the LRP of these operations and locations prior to starting dewatering operations (as well as the regional Water Board as discussed in Section 7.8.1).

The QSD will submit a COI to SMARTS with these new operations and locations. This will include selecting dewatering outlet locations to prevent the dewatering discharge from coming in contact with construction materials or equipment

### ***7.8.5 Dewatering Sampling Schedule***

Sampling of dewatering discharges will be conducted within the first hour of the commencement of discharge and daily each day that the discharge continues. Dewatering operations shall not

commence without the knowledge of the QSP, and shall not commence without the presence of the QSP or QSP trained delegates who are prepared to conduct dewatering discharge sampling for turbidity and pH.

#### 7.8.6. Sample Locations

Sampling locations are based on the planned dewatering locations. Planned dewatering sampling locations are listed in Table 7-16 and shown on the Site Maps in Appendix A.

The number of dewatering sampling location(s) on the project site and the contractor's yard are unknown as of the date of drafting this SWPPP. If the Contractor decides to conduct dewatering operations at the site, the QSP shall identify the dewatering discharge locations and the QSP or QSP delegates shall conduct sampling dewatering discharge for turbidity and pH.

**Table 7-8 Turbidity and pH Dewatering Sample Locations**

Sample Location Identifier	Sample Location Description	Sample Location Latitude and Longitude (Decimal Degrees)
Unknown, TBD	Unknown, TBD	Unknown, TBD

In the event that dewatering is required at a location not listed in Table 7-15, and has not been identified on the Site Maps, sampling locations will be selected by the QSP using the same rationale as that used to identify planned locations. Dewatering sampling locations shall be documented by the QSP or QSP delegates on the *Effluent Sampling Field Log Sheet*, which are provided in Appendix O.

#### 7.8.7 Monitoring Preparation

Dewatering samples will be collected by:

QSP	TBD	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No
QSD Delegate	TBD	<input checked="" type="checkbox"/>	Yes	<input type="checkbox"/>	No

An adequate stock of monitoring supplies and equipment for monitoring turbidity and will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with rain or direct sunlight. The QSP or QSP Delegates will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, field meters, extra batteries, clean powder-free nitrile gloves, sample collection equipment, appropriate sample containers, paper towels, personal rain gear, and *Effluent Sampling Field Log Sheets* and CoC forms provided in Appendix O.

The QSP or QSP Delegates will obtain and maintain the field-testing instruments, as identified in Section 7.7.2.6, for analyzing samples in the field.

#### 7.8.8 Dewatering Sample Collection

Dewatering samples shall be collected at the designated sampling locations determined by the QSP or identified in Table 7-15 and shown on the Site Maps in Appendix A.

Grab samples for turbidity and pH will be collected by following the steps outlined below:

1. Place the pH meter or secondary sample container directly into the stream of flow;
2. Sampling personnel will collect the water up-gradient of where they are standing.

To maintain sample integrity and prevent cross-contamination, sampling collection personnel will:

- Pre-rinse the meter probe or secondary sample container with deionized water or within the flow of runoff;
- Not sample near a running vehicle where exhaust fumes may impact the sample;
- Not touch the exposed end of the meter's probe;
- Not touching inside secondary sampling containers;
- Avoid allowing rainwater to drip from rain gear or other surfaces into secondary sampling containers; and
- Not eat, smoke, or drink during sample collection nor sneeze or cough in the direction of the meter probe or secondary sampling container.

For pH and turbidity samples collected for field analysis, the collection shall be in accordance with SWAMP QAPrP<sup>1</sup> protocols and analysis, and equipment calibration shall be in accordance with field instrument manufacturer's specifications. Table 6-3 below lists the type of instruments used in the field for these parameters.

**Table 7-9: Field Analysis Instrumentation**

<b>Field Instrument</b>	<b>EPA Analytical Method</b>	<b>Parameter</b>	<b>MDL</b>
pH Meter	150.1	pH	0.2
Turbidity Meter	180.1	Turbidity	1

- The instruments will be maintained in accordance with manufacturer's instructions.
- The instrument(s) will be calibrated before each sampling event.
- Maintenance and calibration records will be maintained with the SWPPP.

Immediately following collection, samples for field analysis shall be tested in accordance with the field instrument manufacturer's instructions and results recorded on the Effluent Sampling Field Log Sheet located in Appendix D.

### **7.8.9 Dewatering Sampling Field Analyses**

Discharges from the site are subject to Numeric Action Level (NALs) for pH and turbidity as shown in Table 7-10 below.

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<sup>1</sup> Sampling personnel shall be trained to collect, maintain, and ship samples in accordance with the Surface Water Ambient Monitoring program (SWAMP) 2017 Quality Assurance Program Plan (QAPrP)

**Table 7-10: Numeric Action Levels**

Parameter	Unit	Numeric Action Levels
pH	pH units	Lower NAL < 6.5 Upper NAL > 8.5
Turbidity	NTU	>250 NTU

Compliance with the NAL for pH and turbidity is based on a single sample evaluation. An NAL exceedance occurs when any sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-10.

Turbidity and pH measurements must be conducted immediately. Do not store turbidity or pH samples for later measurement.

The QSP or Delegates shall complete the *Effluent Sampling Field Log Sheets* found in Appendix O while conducting dewatering sample analysis.

#### **7.8.10 Data Evaluation and Reporting**

At least 24 hours prior to the beginning of a dewatering discharge, the QSP or QSP Delegate shall notify the Regional Water Board via email of the anticipated dewatering discharge. The QSP or QSP Delegate shall copy the LRP and QSD on these notification emails.

The QSP shall within five calendar days of the sample collection submit copies of the completed *Effluent Sampling Field Log Sheets* to the LRP and QSD.

Compliance with the NALs for pH and turbidity in dewatering discharges is based on a single sample evaluation. A NAL exceedance occurs when any sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-13.

If the dewatering sampling results show that an NAL was exceeded, the QSP or QSP Delegate shall instruct the Contractor to immediately cease dewatering discharges. If the discharge is necessary to protect human life and health or prevent severe property damage and cannot be ceased, the QSP or QSP Delegates shall notify the Regional Water Board and the Local Stormwater Agency within 24 hours.

**Table 7-17 Dewatering Notification Contacts**

Agency	Name	Email
Regional Water Board	Fresno Branch Office	R5f_stormwater@waterboards.ca.gov
Local MS4 Agency	Fresno Metropolitan Flood Control District	Environmental@fresnofloodcontrol.org

If an NAL for pH or turbidity was exceeded during dewatering operations, the QSP or trained delegates shall inform the QSD and LRP within 5 days and send a copy of the completed *Effluent Sampling Field Log Sheets*.

Exceedances of NALs shall be electronically reported to the State Water Board by the LRP or DAR through SMARTS within 10 days of the NAL exceedance measurement.

### **7.8.11 Dewatering NAL Corrective Actions**

Upon receiving notice that dewatering operations caused a NAL exceedance, the QSD shall investigate the cause of the exceedance and identify corrective actions for dewatering operations.

Following a NAL exceedance, the QSD shall revise the SWPPP to incorporate corrective actions to prevent further exceedances within 10 days of the NAL exceedance measurement.

### **7.9 Sampling and Analysis Plan for Other Pollutants Required by the Regional Water Board**

The Regional Water Board has not specified monitoring for additional pollutants.

### **7.10 Training of Sampling Personnel**

QSP Delegates assigned to conduct sampling shall be trained by the QSP to collect, maintain, and ship samples in accordance with the 2022 CGP Sample Collection and Handling Instructions and supplemental information as needed. Training records of QSP Delegates assigned to sample are provided in Appendix I.

The QSP and QSP Delegates have received the following stormwater sampling training:

<b>Name</b>	<b>Training</b>
TBD and updated via COI	

The QSP and QSP Delegates have the following stormwater sampling experience:

<b>Name</b>	<b>Experience</b>
TBD and updated via COI	

### **7.11 Records Retention**

All records of stormwater monitoring information and copies of reports (including Annual Reports) must be retained for a period of at least three years from date of submittal or longer if required by the Regional Water Board.

Results of visual monitoring, field measurements, and laboratory analyses must be kept in the SWPPP along with CoCs, and other documentation related to the monitoring.

Records are to be kept onsite while construction is ongoing. Records to be retained include:

- The date, place, and time of inspections, sampling, visual observations, and/or measurements, including precipitation;
- The individual(s) who performed the inspections, sampling, visual observation, and/or field measurements;
- The date and approximate time of field measurements and laboratory analyses;
- The individual(s) who performed the laboratory analyses;
- A summary of all analytical results, the method detection limits and reporting limits, and the analytical techniques or methods used;
- Rain gauge readings from site inspections;
- QA/QC records and results;

- Calibration records;
- Visual observation and sample collection exception records;
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations, or inspections;
- Dewatering notifications to the Regional Water Board;
- Dewatering exception notifications to the Regional Water Board and local stormwater agency;



## Section 8 References

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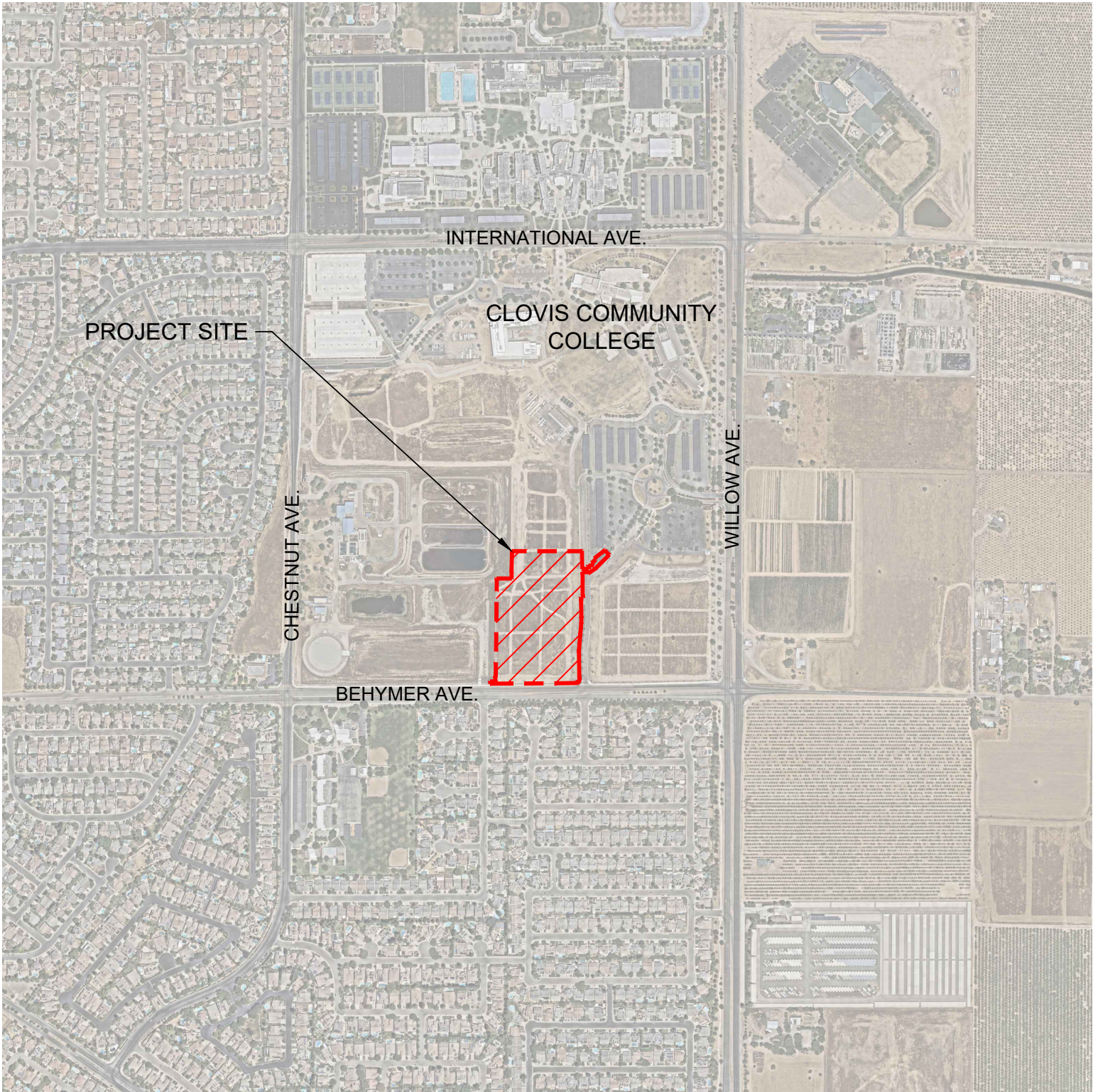
## **Appendix A:      Site Maps and Drawings**

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LOCATION MAP  
NOT TO SCALE













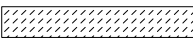


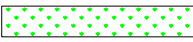

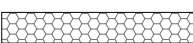
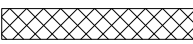
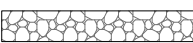
PROJECT SITE  
SCALE: 1"=800'










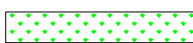
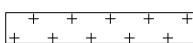

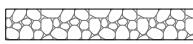
SITE LOCATION: 10309 N. WILLOW AVE.   FRESNO, CA 93730   36.882281, -119.733961					FIGURE: 1A		
 CONSULTANT	<b>Blair, Church &amp; Flynn</b> Consulting Engineers 4811 Clovis Avenue, Suite 200 Clovis, California 93612 Tel (559) 328-1400 Fax (559) 328-1200	STATE CENTER COMMUNITY COLLEGE DISTRICT				DR. BY CH. BY DATE SCALE: AS NOTED	GL MG 10-28-24 OF 7 SHEETS
		STORM WATER POLLUTION PREVENTION PLAN					
		CCC SPORTS COMPLEX LOCATION AND VICINITY MAPS					








CONSTRUCTION SYMBOL LEGEND:

	PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
	PROTECT EXISTING DRAIN INLET PER CASQA SE-10
	SURFACE FLOW DIRECTION
	PROJECT BOUNDARY
	LOCATION OF LINEAR SEDIMENT CONTROL BMPs. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
	EXISTING STORM DRAIN PIPELINE
	EXISTING SWALE/DRAINAGE DITCH/FLOWLINE/GUTTER
	PROPOSED STORM DRAIN PIPELINE
	SWALE/DRAINAGE/DITCH/CULVERT/FLOWLINE/VALLEY GUTTER
	PROPOSED ASPHALT CONCRETE (NON-ROOF IMPERVIOUS AREAS)
	PROPOSED CONCRETE (NON-ROOF IMPERVIOUS AREAS)
	PROPOSED BUILDING (ROOF IMPERVIOUS AREA)
	PROPOSED LANDSCAPING (PERVIOUS AREAS)
	AREAS OF NON-BUILT LAND DISTURBANCE FOR FINAL STABILIZATION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
	PROPOSED SAND AREA (PERVIOUS AREAS)
	PROPOSED RIPRAP/GRAVEL/DECOMPOSED GRANITE (PERVIOUS AREA)
	PROPOSED RUBBER TRACK SURFACE (IMPERVIOUS AREAS)
	LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1










EARTHWORK SYMBOL LEGEND:

	PROTECT EXISTING DRAIN INLET PER CASQA SE-10
	SURFACE FLOW DIRECTION
	PROJECT BOUNDARY
	LOCATION OF LINEAR SEDIMENT CONTROL BMPs. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
	EXISTING STORM DRAIN PIPELINE
	EXISTING SWALE/DRAINAGE DITCH/FLOWLINE/GUTTER
	AREAS OF DEMOLITION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
	AREAS OF NON-BUILT LAND DISTURBANCE. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
	AREAS OF PROPOSED FILL. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
	AREAS OF PROPOSED MINOR GRADING. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
	LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1









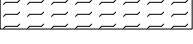


DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

	DRAINAGE AREA "X" BOUNDARY
	DRAINAGE AREA NUMBER
	STORMWATER CONTAINMENT AREA
	STORMWATER RUN-ON CONTROL SAMPLE LOCATION
	QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

	CONCRETE WASHOUT LOCATION PER CASQA WM-08
	LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
	LOCATION OF RAIN GAUGE
	MATERIAL STORAGE LOCATION PER CASQA WM-01
	OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
	RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
	SOLID WASTE STORAGE LOCATION PER CASQA WM-05
	STOCKPILE STORAGE LOCATION PER CASQW WM-03
	WATER SUPPLY LOCATION PER CASQA NS-1

PRE-EARTHWORK SYMBOL LEGEND:

	PROTECT EXISTING DRAIN INLET PER CASQA SE-10
	EXISTING DRAIN INLET TO BE DEMOLISHED. PROTECT INLET PER CASQA SE-10
	SURFACE FLOW DIRECTION
	PROJECT BOUNDARY
	LOCATION OF LINEAR SEDIMENT CONTROL BMPs. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
	EXISTING STORM DRAIN PIPELINE
	EXISTING STORMWATER GUTTER
	EXISTING ASPHALT AND CONCRETE (NON-ROOF IMPERVIOUS AREAS)
	EXISTING PERVIOUS AREAS
	LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
	PRE-CONSTRUCTION GEOTECHNICAL INVESTIGATION BORING LOCATION

NOTES TO CONTRACTOR:

- REFER TO SECTION 3 OF THE PROJECT SWPPP FOR THE BMP IMPLEMENTATION SCHEDULE AND A COMPLETE NARRATIVE ON APPLICABLE BMPs FOR THE PROJECT. REFER TO THE CASQA CONSTRUCTION BMP HANDBOOK IN APPENDIX G TECHNICAL DETAILS ON ALL BMPs.
- IN ADDITION TO THE BMPs DEPICTED HEREON, THE QSP AND CONTRACTOR SHALL STUDY SECTION 3 OF THE PROJECT SWPPP AND APPENDIX G TO SELECT, IMPLEMENT AND MAINTAIN EFFECTIVE BMPs FOR ALL CONSTRUCTION POLLUTANTS ORIGINATING FROM THE SITE THROUGHOUT THE LIFE OF THE PROJECT, IN ACCORDANCE WITH THE CGP.
- THE CONTRACTOR AND QSP SHALL IDENTIFY DISTURBED AREAS THAT ARE NOT PLANNED FOR DISTURBANCE WITHIN THE NEXT 14 DAYS AND IMMEDIATELY TEMPORARILY (OR PERMANENTLY) STABILIZE THESE AREAS USING EFFECTIVE EROSION CONTROL BMPs AS DISCUSSED IN SECTION 3.2 OF THE SWPPP.
- SUFFICIENT QUANTITIES OF TEMPORARY SEDIMENT CONTROL MATERIALS SHALL BE MAINTAINED ON-SITE THROUGHOUT THE DURATION OF THE PROJECT. ALLOWING FOR IMPLEMENTATION OF TEMPORARY SEDIMENT CONTROLS IN THE EVENT OF PREDICTED RAIN AND FOR RAPID RESPONSE DUE TO FAILURES OR EMERGENCY, IN CONFORMANCE WITH OTHER CGP REQUIREMENTS AS DESCRIBED IN THE PROJECT SWPPP.
- STREET SURFACES SHALL BE SWEEP BY THE CONTRACTOR PER CASQA SE-7. VISIBLE SEDIMENT TRACKING SHALL BE SWEEP OR VACUUMED ON A DAILY BASIS.
- DUST CONTROL PRACTICES SHALL CONFORM WITH THE LOCAL AIR DISTRICT AND CASQA WE-1.
- IF CONSTRUCTION IS PHASED, BMPs MAY BE INSTALLED ONLY WITHIN ACTIVE AREAS OF CONSTRUCTION. ONCE EACH PHASE OF CONSTRUCTION IS COMPLETE AND PROJECT AREA IS STABILIZED, BMPs MAY BE REMOVED WITHIN THE STABILIZED AREA.
- THE QSP SHALL CONTINUALLY UPDATE FIGURE 2-4 WITH THE ACTUAL LOCATIONS OF ALL BMPs, AND MAINTAIN A CURRENT COPY IN THE SITE SWPPP BINDER OR ACTIVE DIGITAL VERSION ACCESSIBLE ON-SITE. IF THE IMPLEMENTED BMPs ARE SIGNIFICANTLY DIFFERENT FROM THOSE INDICATED IN THE SWPPP, THE QSP SHALL CONTACT THE QSD TO REQUEST A SWPPP AMENDMENT BE PREPARED AND SUBMITTED TO THE WATER BOARD.
- THE INDICATED STAGING AREAS ARE ASSUMED FOR SCHEMATIC PURPOSES ONLY, AND SHOULD BE COORDINATED WITH THE OWNER. DEPICTION OF STAGING AREAS SHALL NOT GUARANTEE USE OF THOSE AREAS WITHOUT PRIOR PERMISSION. THE QSP SHALL CONTINUALLY UPDATE THESE FIGURES WITH THE ACTUAL LOCATIONS OF ALL STAGING, AND MAINTAIN A CURRENT COPY IN THE SITE SWPPP BINDER. ALL STAGING AREAS SHALL BE FULLY STABILIZED BEFORE CLOSEOUT.
- THE CONTRACTOR SHALL PLAN AND ACHIEVE FINAL STABILIZATION FOR ALL AREAS DISTURBED BY PROJECT ACTIVITIES WITHIN 90 DAYS OF COMPLETING CONSTRUCTION ACTIVITIES. FOR THE PURPOSES OF THIS PROJECT ACCEPTABLE FINAL STABILIZATION CONDITIONS INCLUDES 70% OR GREATER UNIFORM VEGETATIVE COVER OR NON-VEGETATIVE STABILIZATION PER CASQA EC-15.
- THESE SWPPP FIGURES SHOW THE SCOPE OF WORK FOR ALL ADD ALTERNATIVES. BIDDERS SHOULD CONSIDER THE BMPs SHOWN IN THESE FIGURES AS THE SAME FOR THE BASE BID. ADDITIONAL WORK FOR HANDLING AND STORAGE OF ADDITIONAL CONSTRUCTION MATERIALS AND WASTE PER THE CASQA BMP FACTSHEET MAY BE CONSIDERED AS ADDITIONAL COSTS FOR ADD ALTERNATIVES.
- REFER TO THE CONSTRUCTION DRAWINGS FOR MORE DETAIL.

SITE LOCATION: 10309 N. WILLOW AVE. | FRESNO, CA 93730 | 36.882281, -119.733961

FIGURE: 1B

**Blair,  
Church  
& Flynn**  
CONSULTING ENGINEERS

CONSULTANT

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STATE CENTER COMMUNITY COLLEGE DISTRICT

STORM WATER POLLUTION PREVENTION PLAN  
CCC SPORTS COMPLEX  
LEGENDS AND NOTES

DR. BY GL  
CH. BY MG  
DATE 10-28-24  
SCALE: AS NOTED

SHEET NO. 2  
OF 7 SHEETS

EROSION AND SEDIMENT CONTROL BMPS

CASQA BMP#	BMP REQUIREMENT SUMMARY
EC-1	SCHEDULE CLEARING AND GRUBBING DURING DRY WEATHER, WHEN FEASIBLE.
EC-3, EC-4, EC-5, EC-6, EC-7, EC-8, EC-14, EC-15, EC-16	IMPLEMENT EROSION CONTROL BMPS TO DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS.
WE-1	WATER DISTURBED SOIL DAILY TO MITIGATE DUST PER SJVAPCD DUST CONTROL REQUIREMENTS. ESTABLISH CRUST AT END OF WEEK BY WATERING DISTURBED AREAS AND RESTRICTING VEHICLE ACCESS.
SE-10	PROTECT STORM DRAIN INLETS, TRENCH DRAINS, GUTTERS, DITCHES, AND DRAINAGE COURSES WITH APPROPRIATE BMPS, SUCH AS GRAVEL BAGS, INLET FILTER, BERMS, ETC. (SEE DETAILS SE-10a & SE-10b)
SE-1, SE-2, SE-3, SE-4, SE-5, SE-6, SE-8, SE-12, SE-13	PREVENT SEDIMENT FROM MIGRATING OFFSITE BY INSTALLING AND MAINTAINING SEDIMENT CONTROLS, SUCH AS FIBER ROLLS, SILT FENCES, OR SEDIMENT BASINS.
WM-7	IF ANY OF THE FOLLOWING CONDITIONS ARE OBSERVED, TEST FOR CONTAMINATION AND CONTACT LOCAL COUNTY ENVIRONMENTAL HEALTH DEPARTMENT, REGIONAL WATER QUALITY CONTROL BOARD, AND LOCAL MUNICIPAL INSPECTOR: UNUSUAL SOIL CONDITIONS, DISCOLORATION, OR ODOR, ABANDONED UNDERGROUND TANKS ABANDONED WELLS, BURIED BARRELS, DEBRIS, OR TRASH.
TC-1, TC-2	ESTABLISH AND MAINTAIN EFFECTIVE STABILIZED CONSTRUCTION EXIT AT ALL CONSTRUCTION EXITS TO SUFFICIENTLY CONTROL TRACKING OFF SITE (SEE DETAIL TC-1).
SE-7	SWEEP OR VACUUM ANY STREET TRACKING IMMEDIATELY UPON OBSERVATION. NEVER HOSE DOWN STREETS TO CLEAN UP TRACKING.

SPILL PREVENTION AND CONTROL BMPS

CASQA BMP#	BMP REQUIREMENT SUMMARY
WM-4, WM-6	KEEP SPILL KIT AVAILABLE AT SITE AT ALL TIMES (ABSORBENT, SPILL BOOMS, DISPOSAL BAGS, PPE). TRAIN STAFF ON SPILL CLEANUP RESPONSIBILITY AND PROCEDURES.
WM-4, WM-6, NS-10	INSPECT VEHICLES AND EQUIPMENT FREQUENTLY FOR AND REPAIR LEAKS PROMPTLY. USE DRIP PANS TO CATCH LEAKS UNTIL REPAIRS ARE MADE.
WM-4, WM-6	CLEAN UP SPILLS OR LEAKS IMMEDIATELY AND DISPOSE OF CLEANUP MATERIALS PROPERLY.
WM-4, WM-6	DO NOT HOSE DOWN SURFACES WHERE FLUIDS HAVE SPILLED. USE DRY CLEANUP METHODS (ABSORBENT MATERIALS).
WM-4, WM-6	SWEEP UP SPILLED DRY MATERIALS IMMEDIATELY (CONCRETE, MORTAR, DRYWALL PLASTER ETC.). DO NOT WASH THEM AWAY WITH WATER, OR BURY THEM.
WM-4, WM-6, WM-7	CLEAN UP SPILLS ON DIRT AREAS BY DIGGING UP AND PROPERLY DISPOSING OF CONTAMINATED SOIL.
WM-4, WM-6	REPORT SIGNIFICANT SPILLS IMMEDIATELY. YOU ARE REQUIRED BY LAW TO REPORT ALL SIGNIFICANT RELEASES OF HAZARDOUS MATERIALS, INCLUDING OIL. TO REPORT A SPILL: DIAL 911.

PAINTING AND PAINT REMOVAL BMPS

CASQA BMP#	BMP REQUIREMENT SUMMARY
WM-6, WM-10	NEVER CLEAN BRUSHES OR RINSE PAINT CONTAINERS INTO STREET, GUTTER, STORM DRAIN, SOIL, OR SURFACE WATERS.
WM-6, WM-10	FOR WATER-BASED PAINTS, PAINT OUT BRUSHES TO THE EXTENT POSSIBLE. RINSE TO THE SANITARY SEWER ONCE YOU HAVE GAINED PERMISSION FROM THE LOCAL WASTEWATER TREATMENT AUTHORITY. NEVER POUR PAINT DOWN A DRAIN OR ONTO SOIL.
WM-6, WM-10	FOR OIL-BASED PAINTS, PAINT OUT BRUSHES TO THE EXTENT POSSIBLE AND CLEAN WITH THINNER OR SOLVENT IN A PROPER CONTAINER. FILTER AND REUSE THINNERS AND SOLVENTS. DISPOSE OF RESIDUE AND UNUSABLE THINNER/SOLVENTS AS HAZARDOUS WASTE.
WM-5, WM-6,	CHEMICAL PAINT STRIPPING RESIDUE AND CHIPS AND DUST FROM PAINTS CONTAINING LEAD OR TRIBUTYL TIN MUST BE DISPOSED OF AS HAZARDOUS WASTE.
WM-5, WM-6,	PAINT CHIPS AND DUST FROM NON-HAZARDOUS DRY STRIPPING AND SAND BLASTING MAY BE SWEEPED UP OR COLLECTED IN PLASTIC DROP CLOTHS AND DISPOSED OF AS TRASH.

ASPHALT, CONCRETE, MORTAR, STUCCO BMPS

CASQA BMP#	BMP REQUIREMENT SUMMARY
NS-3, NS-12, NS-13	DO NOT PAVE, SEAL COAT, OR POUR CONCRETE IN WET WEATHER, OR WHEN RAIN IS FORECAST BEFORE FRESH PAVEMENT/CONCRETE WILL HAVE TIME TO CURE.
NS-3, NS-12, NS-13	COVER STORM DRAIN INLETS AND MANHOLES WHEN APPLYING SEAL COAT, TACK COAT, SLURRY SEAL, FOG SEAL, ETC.
WM-5	COLLECT AND RECYCLE OR APPROPRIATELY DISPOSE OF EXCESS ABRASIVE GRAVEL OR SAND. DO NOT SWEEP OR WASH IT INTO GUTTERS.
NS-3, NS-12, NS-13, WM-8	DO NOT USE WATER TO WASH DOWN FRESH ASPHALT OR CONCRETE PAVEMENT.
NS-3, WM-8	COMPLETELY COVER OR BARRICADE STORM DRAIN INLETS WHEN SAW CUTTING. USE DRAIN INLET PLUG OR SAND BAGS TO KEEP SLURRY OUT OF THE STORM DRAIN SYSTEM.
NS-3, WM-8	ABOSORB, OR VACUUM SAW-CUT SLURRY AND DISPOSE OF ALL WASTE AS SOON AS YOU ARE FINISHED IN ONE LOCATION OR AT THE END OF EACH WORK DAY (WHICHEVER IS SOONER).
NS-3, WM-8	IF SAWCUT SLURRY ENTERS A CATCH BASIN, CLEAN IT UP IMMEDIATELY.
WM-1	STORE CONCRETE, GROUT, MORTAR, STUCCO, ETC. UNDER COVER AND RAISED OFF GROUND, AND AWAY FROM DRAINAGE COURSES. THESE MATERIALS MUST NEVER REACH A STORM DRAIN.
WM-4, WM-8	CONCRETE WASHOUT AND OTHER LIQUID WASTE FROM MORTAR, GROUT, STUCCO, PLASTER, DRYWALL, ETC. MUST BE STORED IN CONTAINMENT BIN/BUCKET. THESE LIQUID WASTES MAY NOT BE DISPOSED ON SOIL OR DRAINAGE COURSES. SELECT A CONTAINER LARGE ENOUGH FOR THE JOB AND LEAVE FREEBOARD TO PREVENT SPILLS OF CONTAINER. COVER CONTAINERS FOR ALL RAIN EVENTS.
WM-4, WM-8	COLLECT THE WASH WATER FROM WASHING EXPOSED AGGREGATE CONCRETE AND REMOVE IT FOR APPROPRIATE DISPOSAL OFFSITE.
WM-2, WM-5, WM-8	PLACE TARP UNDER SOIL OF MORTAR, STUCCO, PLASTER, ETC. MIXING STATIONS AND UNDER APPLICATION AREAS. CONTAIN THESE MATERIALS ON TARP FROM SCRAPING FROM OVER-APPLICATION. COLLECT AND DISPOSE MATERIALS ACCUMULATED ON TARP IMMEDIATELY AFTER CURING.

RUN-ON AND DEWATERING BMPS

CASQA BMP#	BMP REQUIREMENT SUMMARY
SE-8, EC-9	EFFECTIVELY DIVERT RUN-ON TO DISTURBED AREAS BY USE OF SANDBAG BERMS OR DIVERSION PIPE/HOSE. WHEN DIVERSION IS INFEASIBLE, SCHEDULE WORK DISTURBANCE TO RUN-ON AREAS DURING DRY WEATHER IF FEASIBLE. IF RUN-ON TO DISTURBED AREAS IS UNAVOIDABLE, IMPLEMENT A COMBINATION OF EFFECTIVE EROSION AND SEDIMENT CONTROLS TO MINIMIZE POLLUTANT TRANSPORT FROM RUN-ON.
NS-2	WHEN DEWATERING OFF-SITE, NOTIFY AND OBTAIN APPROVAL FROM THE LOCAL MUNICIPALITY AND REGIONAL WATER QUALITY CONTROL BOARD BEFORE DISCHARGING IMPOUNDED WATER OFF-SITE. SEE SECTION 7 OF THE PROJECT SWPPP FOR SITE-SPECIFIC DEWATERING PERMIT/SAMPLING REQUIREMENTS.
EC-10	UTILIZE VELOCITY DISSIPATION DEVICES WHEN DEWATERING TO PERVIOUS AREAS.
NS-2, WM-7	IN AREAS OF KNOWN CONTAMINATION, TESTING IS REQUIRED PRIOR TO REUSE OR DISCHARGE OF GROUNDWATER OR IMPOUNDED STORMWATER. CONSULT WITH THE ENGINEER AND MUNICIPAL STAFF TO DETERMINE WHETHER TESTING IS REQUIRED AND HOW TO INTERPRET RESULTS. CONTAMINATED GROUNDWATER OR IMPOUNDED WATER MUST BE TREATED OR HAULED OFFSITE FOR PROPER DISPOSAL.

EQUIPMENT MAINTENANCE AND PARKING BMPS

CASQA BMP#	BMP REQUIREMENT SUMMARY
NS-8, NS-9, NS-10	DESIGNATE AN AREA, FITTED WITH APPROPRIATE BMPS, FOR VEHICLE AND EQUIPMENT PARKING AND STORAGE.
NS-8, NS-9, NS-10	PERFORM MAJOR MAINTENANCE, REPAIR JOBS, AND VEHICLE AND EQUIPMENT WASHING OFF-SITE.
NS-9, NS-10	IF REFUELING OR VEHICLE MAINTENANCE MUST BE DONE ONSITE, WORK IN A BERMED AREA AWAY FROM STORM DRAINS AND OVER A DRIP PAN BIG ENOUGH TO COLLECT FLUIDS. RECYCLE OR DISPOSE OF FLUIDS AS HAZARDOUS WASTE.
NS-8	IF VEHICLE OR EQUIPMENT CLEANING MUST BE DONE ONSITE, CLEAN WITH WATER ONLY IN A BERMED AREA THAT WILL NOT ALLOW RINSE WATER TO RUN INTO GUTTERS, STREETS, STORM DRAINS, OR SURFACE WATERS
NS-8	DO NOT CLEAN VEHICLES OR EQUIPMENT ON-SITE USING SOAPS, SOLVENTS, DEGREASERS, STEAM CLEANING EQUIPMENT, ETC.

MATERIAL & WASTE MANAGEMENT BMPS

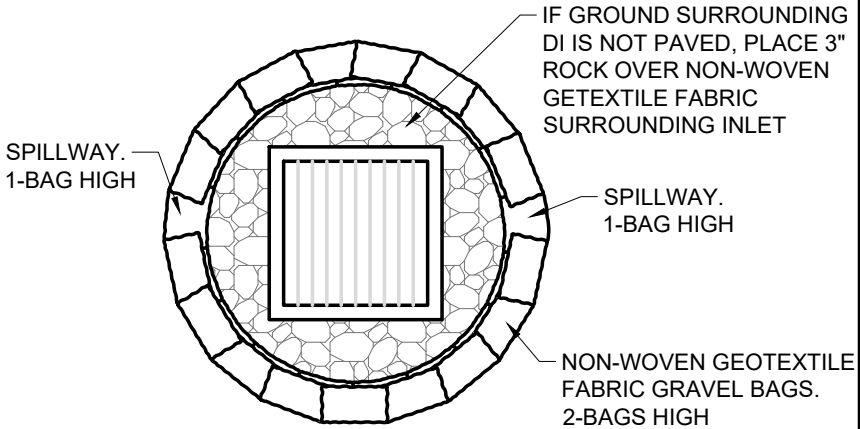
CASQA BMP#	BMP REQUIREMENT SUMMARY
WM-1, WM-3	BERM AND SECURELY COVER STOCKPILES OF SAND, DIRT, OR OTHER CONSTRUCTION MATERIALS WITH TARPS WHEN RAIN IS FORECAST OR IF STOCKPILES ARE NOT ACTIVELY BEING USED. FOR BEST RESULTS, THIS SHOULD BE DONE AT THE END OF THE WORK DAY THROUGHOUT CONSTRUCTION WHEN FEASIBLE.
WM-5, WM-6	BERM AND SECURELY COVER STOCKPILES OF ALL DEMOLISHED BUILDING RUBBLE.
WM-4, WM-6, WM-10	LABEL ALL HAZARDOUS MATERIALS AND HAZARDOUS WASTES (SUCH AS PESTICIDES, PAINTS, THINNERS, SOLVENTS, FUEL, OIL, AND ANTIFREEZE) IN ACCORDANCE WITH CITY, COUNTY, STATE AND FEDERAL REGULATIONS.
WM-4, WM-6, WM-10	STORE HAZARDOUS MATERIALS AND WASTES IN WATER TIGHT CONTAINERS, STORE IN APPROPRIATE SECONDARY CONTAINMENT, AND COVER THEM AT THE END OF EVERY WORK DAY OR DURING WET WEATHER OR WHEN RAIN IS FORECAST.
WM-2,WM-4, WM-6, WM-10, NS-12, NS-13	FOLLOW MANUFACTURER'S APPLICATION INSTRUCTIONS FOR HAZARDOUS MATERIALS AND BE CAREFUL NOT TO USE MORE THAN NECESSARY. DO NOT APPLY CHEMICALS OUTDOORS WHEN RAIN IS FORECAST WITHIN 24 HOURS.
WM-6	ARRANGE APPROPRIATE DISPOSAL OF ALL HAZARDOUS WASTES.
WM-5	COVER WASTE DISPOSAL CONTAINERS SECURELY WITH TARPS AT THE END OF EVERY WORK DAY AND DURING WET WEATHER.
WM-9	CLEAN OR REPLACE PORTABLE TOILETS, AND INSPECT THEM FREQUENTLY FOR LEAKS AND SPILLS. ADD SECONDARY CONTAINMENT AND LOCATE THEM AWAY FROM STORM DRAIN INLETS. ENSURE TOILETS ARE PROTECTED FROM TIPPING FROM HIGH WIND.
WM-5	WHEN CUTTING OR GRINDING METAL OR PLASTIC MATERIALS (PVC PIPE, SIDING, ETC.) PLACE DROPCLOTH OR TARP TO CONTAIN INORGANIC (TRASH) SHARDS/SHAVINGS/DUST. DISPOSE COLLECTED MATERIALS AFTER COMPLETING CUTTING/GRINDING ACTIVITY.

LANDSCAPING BMPS

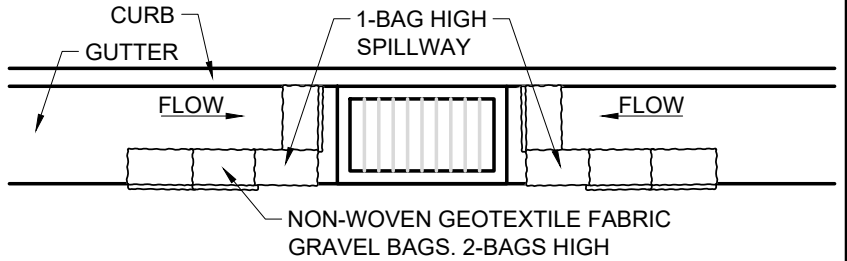
CASQA BMP#	BMP REQUIREMENT SUMMARY
WM-1, WM-3	CONTAIN STOCKPILED LANDSCAPING MATERIALS BY STORING THEM UNDER TARPS AND BERMED FROM RUN-ON WHEN THEY ARE NOT ACTIVELY BEING USED.
WM-1, WM-3	STORE ERODIBLE LANDSCAPE MATERIAL ON PALLETS. COVER OR STORE THESE MATERIALS WHEN THEY ARE NOT ACTIVELY BEING USED OR APPLIED.
WM-1, WM-3	DISCONTINUE APPLICATION OF ANY ERODIBLE LANDSCAPE MATERIAL WITHIN 2 DAYS BEFORE A FORECAST RAIN EVENT OR DURING WET WEATHER.
NS-7	COORDINATE WITH OWNER TO MODIFY EXISTING IRRIGATION SYSTEMS IN/AROUND PROJECT SITE TO ENSURE IRRIGATION WATER IS NOT A SOURCE OF NON-STORMWATER INTO DISTURBED AREAS.

ADDITIONAL BMP GUIDANCE DETAILS

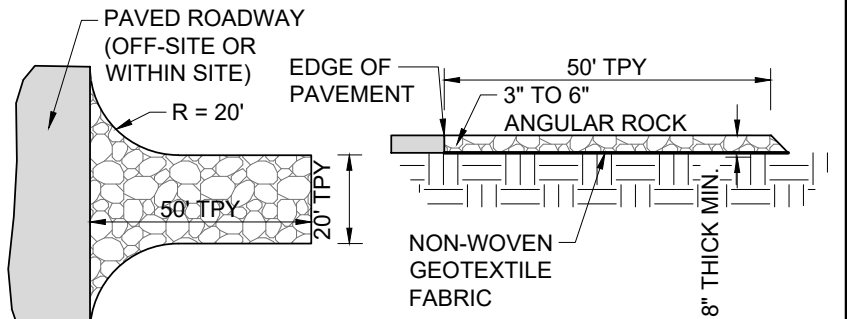
BMP DETAILS SHOWN BELOW PROVIDE ADDITIONAL BMP GUIDANCE NOT INCLUDED IN THE CASQA BMP FACTSHEET. ALL OTHER BMPS SHALL FOLLOW GUIDANCE IN THE FACTHEET IN APPENDIX G OF THE PROJECT SWPPP.



SE 10a LEVEL GRADE DRAIN INLET PROTECTION  
NOT TO SCALE



SE 10b CURB & GUTTER DRAIN INLET PROTECTION  
NOT TO SCALE

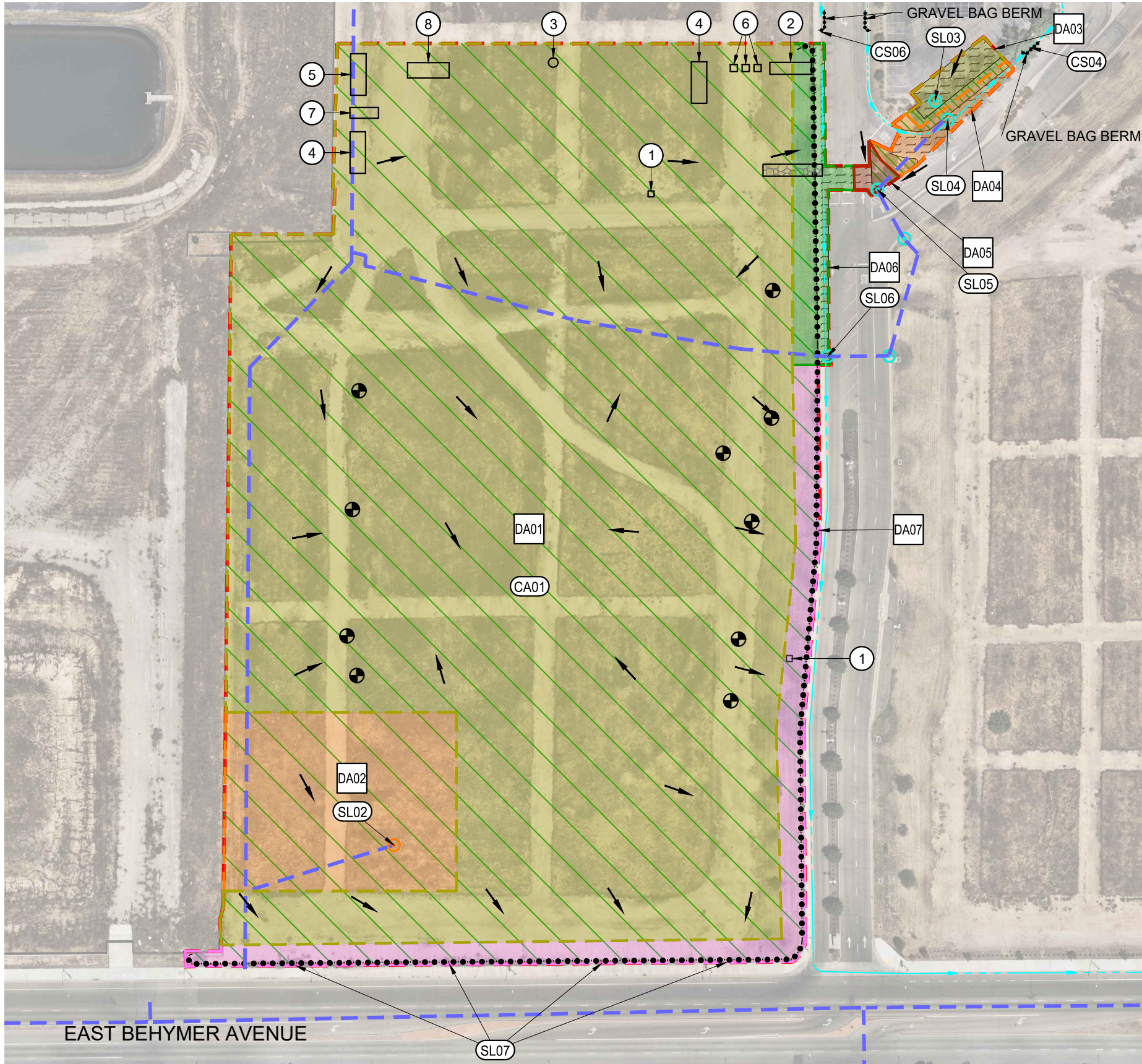


- NOTES:
- CONSTRUCTION EXIT SHALL BE KEPT IN GOOD CONDITION BY OCCASIONAL TOP DRESSING AND/OR ROUGHENING.
  - "RUMBLE PLATES" MAY BE ADDED AND COUNT TOWARDS 50' FT REQUIREMENT.
  - CONTRACTOR SHALL INSPECT EXIT WEEKLY AND DURING RAIN EVENTS.
  - CONTRACTOR SHALL SWEEP TRACKOUT WEEKLY AND PRIOR TO RAIN EVENTS PER CASQA SE-7 AND PER SJVAPCD DUST CONTROL REQUIREMENTS

TC 1 STABILIZED CONSTRUCTION EXIT  
NOT TO SCALE

SITE LOCATION: 10309 N. WILLOW AVE.   FRESNO, CA 93730   36.882281, -119.733961		FIGURE: 1C	
	CONSULTANT	STATE CENTER COMMUNITY COLLEGE DISTRICT	
	Blair, Church & Flynn Consulting Engineers 481 Lewis Avenue, Suite 200 Clovis, California 93612 Tel (559) 326-1400 Fax (559) 326-1200	STORM WATER POLLUTION PREVENTION PLAN CCC SPORTS COMPLEX BMP SUMMARY AND DETAILS	
		DR. BY CH. BY DATE SCALE: AS NOTED	GL MG 10-28-24 AS NOTED
		SHEET NO. 3 OF 7 SHEETS	





**PRE-EARTHWORK SYMBOL LEGEND:**

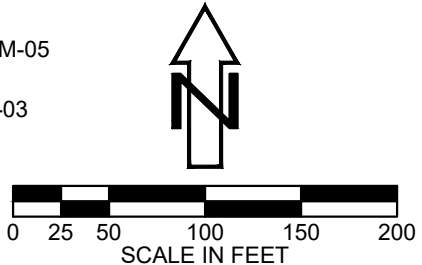
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- EXISTING DRAIN INLET TO BE DEMOLISHED. PROTECT INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMP'S. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING STORMWATER GUTTER
- EXISTING ASPHALT AND CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- PRE-CONSTRUCTION GEOTECHNICAL INVESTIGATION BORING LOCATION

**DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:**

- DRAINAGE AREA "X" BOUNDARY
- DRAINAGE AREA NUMBER
- STORMWATER CONTAINMENT AREA
- STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

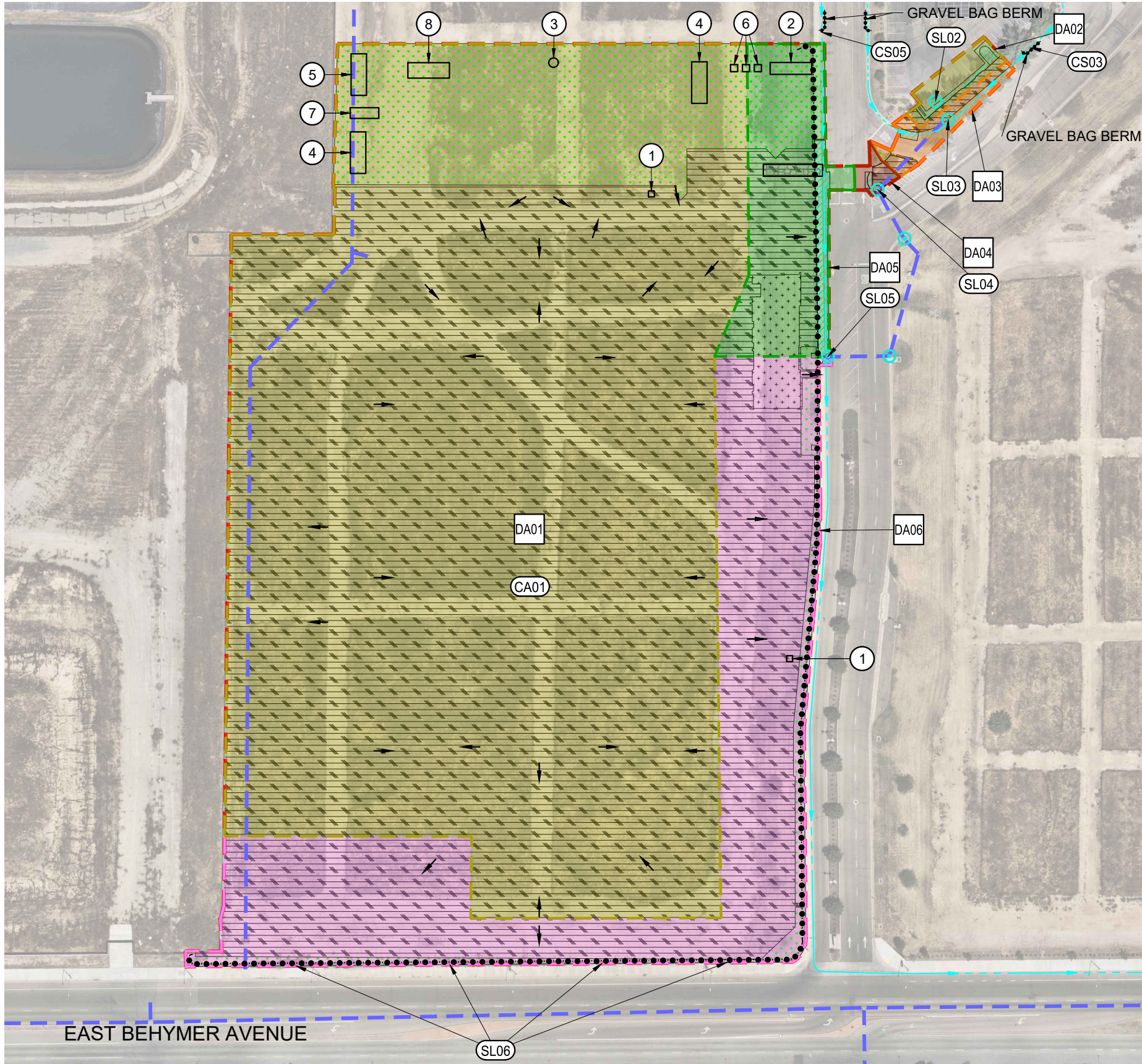
**STAGING AREA ITEMS:**

- CONCRETE WASHOUT LOCATION PER CASQA WM-08
- LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
- LOCATION OF RAIN GAUGE
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SITE LOCATION: 10309 N. WILLOW AVE.   FRESNO, CA 93730   36.882281, -119.733961		FIGURE: 2		
	STATE CENTER COMMUNITY COLLEGE DISTRICT			
	STORM WATER POLLUTION PREVENTION PLAN			
	CCC SPORTS COMPLEX			
PRE-EARTHWORK SITE MAP			DR. BY GL CH. BY MG DATE 10-28-24 SCALE: AS NOTED	SHEET NO. 4 OF 7 SHEETS





EARTHWORK SYMBOL LEGEND:

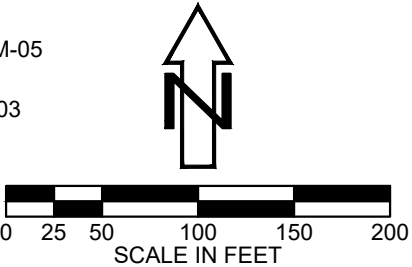
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPs. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING SWALE/DRAINAGE DITCH/FLOWLINE/GUTTER
- AREAS OF DEMOLITION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF NON-BUILT LAND DISTURBANCE. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF PROPOSED FILL. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF PROPOSED MINOR GRADING. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY
- DRAINAGE AREA NUMBER
- STORMWATER CONTAINMENT AREA
- STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

- ① CONCRETE WASHOUT LOCATION PER CASQA WM-08
- ② LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
- ③ LOCATION OF RAIN GAUGE
- ④ MATERIAL STORAGE LOCATION PER CASQA WM-01
- ⑤ OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
- ⑥ RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
- ⑦ SOLID WASTE STORAGE LOCATION PER CASQA WM-05
- ⑧ STOCKPILE STORAGE LOCATION PER CASQW WM-03
- WS WATER SUPPLY LOCATION PER CASQA NS-1



SITE LOCATION: 10309 N. WILLOW AVE. | FRESNO, CA 93730 | 36.882281, -119.733961

FIGURE: 3



CONSULTANT  
Blair, Church & Flynn  
Consulting Engineers  
481 Chris Avenue,  
Suite 200  
Clovis, California 93612  
Tel (559) 328-1400  
Fax (559) 328-1200

STATE CENTER COMMUNITY COLLEGE DISTRICT

STORM WATER POLLUTION PREVENTION PLAN  
CCC SPORTS COMPLEX  
EARTHWORK SITE MAP

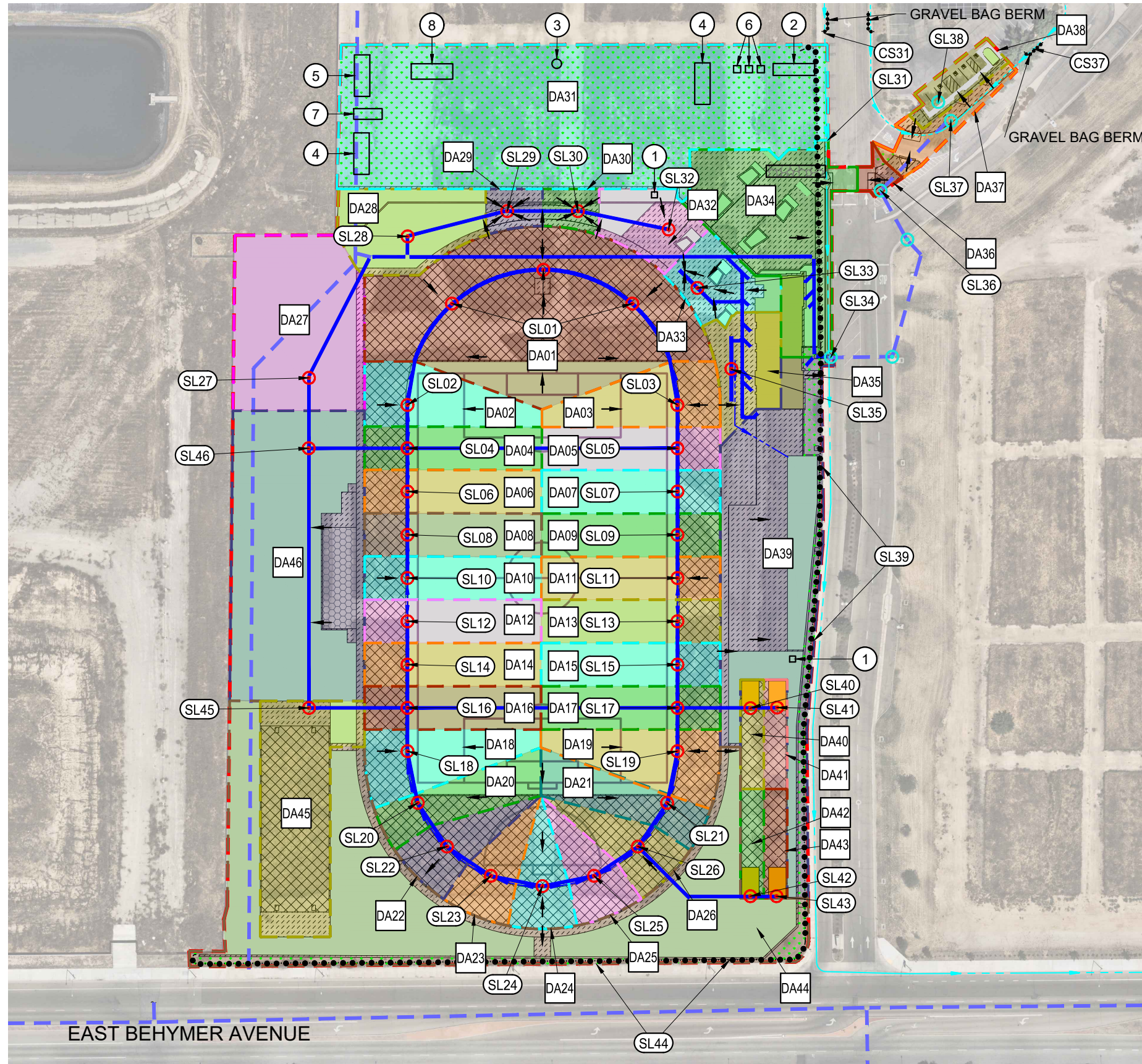
DR. BY GL  
CH. BY MG  
DATE 10-28-24  
SCALE: AS NOTED

SHEET NO. 5  
OF 7 SHEETS









CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPs. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING SWALE/DRAINAGE DITCH/FLOWLINE/GUTTER
- PROPOSED STORM DRAIN PIPELINE
- SWALE/DRAINAGE/DITCH/CULVERT/FLOWLINE/VALLEY GUTTER
- PROPOSED ASPHALT CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED BUILDING (ROOF IMPERVIOUS AREA)
- PROPOSED LANDSCAPING (PERVIOUS AREAS)
- AREAS OF NON-BUILT LAND DISTURBANCE FOR FINAL STABILIZATION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPs. SEE NOTE 3 ON FIGURE 1B.
- PROPOSED SAND AREA (PERVIOUS AREAS)
- PROPOSED RIPRAP/GRAVEL/DECOMPOSED GRANITE (PERVIOUS AREA)
- PROPOSED RUBBER TRACK SURFACE (IMPERVIOUS AREAS)
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY
- DRAINAGE AREA NUMBER
- STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

- CONCRETE WASHOUT LOCATION PER CASQA WM-08
- LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
- LOCATION OF RAIN GAUGE
- MATERIAL STORAGE LOCATION PER CASQA WM-01
- OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
- RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
- SOLID WASTE STORAGE LOCATION PER CASQA WM-05
- STOCKPILE STORAGE LOCATION PER CASQA WM-03
- WATER SUPPLY LOCATION PER CASQA NS-1



SITE LOCATION: 10309 N. WILLOW AVE. | FRESNO, CA 93730 | 36.882281, -119.733961

FIGURE: 4.i

**Blair,  
Church &  
Flynn**  
CONSULTING ENGINEERS

CONSULTANT  
Blair, Church & Flynn  
Consulting Engineers  
4811 Lewis Avenue,  
Suite 200  
Clovis, California 93612  
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Fax: (559) 328-1200

STATE CENTER COMMUNITY COLLEGE DISTRICT

STORM WATER POLLUTION PREVENTION PLAN  
CCC SPORTS COMPLEX  
DRAINAGE AREA AND SAMPLING SITE MAP - CONSTRUCTION

DR. BY GL  
CH. BY MG  
DATE 10-28-24  
SCALE: AS NOTED

SHEET NO. 7  
OF 7 SHEETS



## **Appendix B: Permit Registration Documents**

---

Permit Registration Documents included in this Appendix:

<b>Location in SWPPP</b>	<b>Permit Registration Document</b> (in addition to a copy of the SWPPP)
Appendix A	Site Maps and Drawings
Appendix B	Notice of Intent
Appendix B	Risk Level Determination
N/A	Certification (LRP Certification is provided electronically with SMARTS PRD submittal)
Appendix Q	Post-Construction Requirements, if applicable
Appendix B	Copy of Annual Fee Receipt
N/A	ATS Design Documents, if applicable
N/A	Passive Treatment Design Documents, if applicable

ction - NOI

Application ID: 576874

Status: Not Submitted

Sediment Risk

Receiving Water Risk

Combined Risk

### 1. SEDIMENT RISK FACTOR CALCULATION

Instructions: Enter R, K, and LS factor values. System will calculate watershed erosion estimates and segment sediment risk factor.

A) R Factor Value: **\*(What's this?)**

40.51

[Erosivity Calculator Help](#)

Populate K and LS using GIS layer data

B) K Factor Value: (weighted average, by area, for all site soils) **\*(What's this?)**

0.32

C) LS Factor: (weighted average, by area, for all slopes) **\*(What's this?)**

0.18963173

Watershed Erosion Estimate (=R\*K\*LS) in tons/acre

2.458234042336

Project Sediment Risk Factor: **(What's this?)**

Low

Save & Continue

ction - NOI

Application ID: 576874

Status: Not Submitted

Sediment Risk

Receiving Water Risk

Combined Risk

### 2. RECEIVING WATER RISK FACTOR CALCULATION

[Statewide Map of High Receiving Water Risk Watersheds](#)

A. Watershed Characteristics

A.1.(a) Does the disturbed area discharge directly or indirectly to a 303(d) listed waterbody impaired by sediment?

OR

A.1.(b) Is the disturbed area located within a sub-watershed draining to a 303(d) listed waterbody impaired by sediment?

OR

A.2. Is the disturbed area located within a planning watershed draining to a waterbody with designated beneficial uses of COLD, SPAWN AND MIGRATORY?

Receiving Water Risk (answer to above questions): **No**

Populate Receiving Water Risk

Project Receiving Water Risk Factor: **Low**

Save & Continue

tion - NOI

Application ID: 576874

Status: Not Submitted

Sediment Risk

Receiving Water Risk

Combined Risk

### 3. COMBINED RISK LEVEL MATRIX

		Sediment Risk		
		Low	Medium	High
Receiving Water Risk	Low	Level1	Level2	
	High	Level2		Level3

Project Sediment Risk: **Low**

Project Receiving Water Risk: **Low**

Project Combined Risk: **Level1**

Continue

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## National Pollutant Discharge Elimination System (NPDES)

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# Rainfall Erosivity Factor Calculator for Small Construction

## Introduction

EPA's stormwater regulations allow NPDES permitting authorities to waive NPDES permitting requirements for stormwater discharges from small construction sites if:

- the construction site disturbs less than five acres, and
- the rainfall erosivity factor ("R" in the revised universal soil loss equation, or RUSLE) value is less than five during the period of construction activity.

If your small construction project is located in an area where EPA is the permitting authority and your R factor is less than five, you qualify for a low erosivity waiver (LEW) from NPDES stormwater permitting. If your small construction project does not qualify for a waiver, then NPDES stormwater permit coverage is required. Follow the steps below to calculate your R-Factor.

LEW certifications are submitted through the NPDES eReporting Tool or "CGP-NeT". Several states that are authorized to implement the NPDES permitting program also accept LEWs. Check with your state NPDES permitting authority for more information.

- Submit your LEW through EPA's eReporting Tool <<https://www.epa.gov/npdes/submitted-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>>

- List of states, Indian country, and territories where EPA is the permitting authority (pdf) <<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit-cover.pdf>>
- Construction Rainfall Erosivity Waiver Fact Sheet <<https://www.epa.gov/npdes/construction-rainfall-erosivity-waiver-fact-sheet>>
- Small Construction Waivers and Instructions (pdf) <<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-c-waivers.pdf>>

The R-factor calculation can also be integrated directly into custom applications using the R-Factor web service <<https://epa.gov/api-docs/>>.

## Steps to Calculate an R Factor for your Small Construction Project

- 1 Select the estimated start and end dates of construction by clicking the calendar icons below and using the dropdown calendar. The period of construction activity begins at initial earth disturbance and ends with final stabilization.

**Start Date:**

01/14/2025

**End Date:**

01/13/2026

- 2 Locate your small construction project by entering the address in the search box or by clicking on the map.

**Location:**

-119.7338234454838 , 36.882300746909

**Search**

+

—



3 Click the "Calculate R Factor" button below.

### Calculate R Factor

## Facility Information

<b>Start Date:</b> 01/14/2025	<b>Latitude:</b> 36.8823
<b>End Date:</b> 01/13/2026	<b>Longitude:</b> -119.7338

## Calculation Results

**Rainfall erosivity factor (R Factor) = 26.28**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site's period of construction.

**You do NOT qualify for a waiver from NPDES permitting requirements and must seek Construction General Permit (CGP) coverage.** If you are located in an area where EPA is the permitting authority (pdf)

<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit->

 An official website of the United States government

MENU

## National Pollutant Discharge Elimination System (NPDES)

CONTACT US

SHARE   

# Rainfall Erosivity Factor Calculator for Small Construction

## Introduction

EPA's stormwater regulations allow NPDES permitting authorities to waive NPDES permitting requirements for stormwater discharges from small construction sites if:

- the construction site disturbs less than five acres, and
- the rainfall erosivity factor ("R" in the revised universal soil loss equation, or RUSLE) value is less than five during the period of construction activity.

If your small construction project is located in an area where EPA is the permitting authority and your R factor is less than five, you qualify for a low erosivity waiver (LEW) from NPDES stormwater permitting. If your small construction project does not qualify for a waiver, then NPDES stormwater permit coverage is required. Follow the steps below to calculate your R-Factor.

LEW certifications are submitted through the NPDES eReporting Tool or "CGP-NeT". Several states that are authorized to implement the NPDES permitting program also accept LEWs. Check with your state NPDES permitting authority for more information.

- Submit your LEW through EPA's eReporting Tool <<https://www.epa.gov/npdes/submitted-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>>

- List of states, Indian country, and territories where EPA is the permitting authority (pdf) <<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit-cover.pdf>>
- Construction Rainfall Erosivity Waiver Fact Sheet <<https://www.epa.gov/npdes/construction-rainfall-erosivity-waiver-fact-sheet>>
- Small Construction Waivers and Instructions (pdf) <<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-c-waivers.pdf>>

The R-factor calculation can also be integrated directly into custom applications using the R-Factor web service <<https://epa.gov/api-docs/>>.

## Steps to Calculate an R Factor for your Small Construction Project

- 1 Select the estimated start and end dates of construction by clicking the calendar icons below and using the dropdown calendar. The period of construction activity begins at initial earth disturbance and ends with final stabilization.

**Start Date:**

01/13/2026

**End Date:**

05/06/2026

- 2 Locate your small construction project by entering the address in the search box or by clicking on the map.

**Location:**

-119.7338234454838 , 36.882300746909

**Search**

+

—





3 Click the "Calculate R Factor" button below.

### Calculate R Factor

## Facility Information

<b>Start Date:</b> 01/13/2026	<b>Latitude:</b> 36.8823
<b>End Date:</b> 05/06/2026	<b>Longitude:</b> -119.7338

## Calculation Results

**Rainfall erosivity factor (R Factor) = 14.23**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site's period of construction.

**You do NOT qualify for a waiver from NPDES permitting requirements and must seek Construction General Permit (CGP) coverage.** If you are located in an area where EPA is the permitting authority (pdf)

<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit->

## **Appendix C: SWPPP Amendment QSD Certifications**

---

## SWPPP Amendment No.

---

Project Name: CCC Sports Complex

---

Project Number: TBD

---

### Qualified SWPPP Developer's Certification of the Stormwater Pollution Prevention Plan Amendment

"This Stormwater Pollution Prevention Plan and its appendices were prepared under my direction to meet the requirements of the 2022 CGP (SWRCB Order No. 2022-0057-DWQ). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below."

---

QSD's Signature

---

Date

---

QSD Name

---

QSD Certificate Number

---

Title and Affiliation

---

Telephone

---

Address

---

Email

---

---

## **Appendix D: Submitted Changes of Information**

---

## Log of Updated PRDs

The 2022 CGP allows for the reduction or increase of the total acreage when a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

A Change of Information (COI) shall be filed electronically within the timeframe shown in the table below. The SWPPP shall be modified appropriately, with revisions and amendments recorded in the SWPPP Amendment Log at the front of the SWPPP. COIs submitted electronically via SMARTS can be found in this Appendix.

Reason for Filing COI	Timeline for Filing COI
Reduction or increase in total disturbed area	Within 30 days of the reduction or increase
Updating site specific BMPs	Within 14 days of design change
Change construction start or end date	At least 14 days prior to the date to be changed
Post-construction plans updated or approved by the municipal stormwater permittee	Within 14 days of approval

---

This appendix includes all of the following updated PRDs (check all that apply):

- ☐ Change of Information;
- ☐ Revised Site Map;
- ☐ Revised Risk Assessment;
- ☐ New landowner's information (name, address, phone number, email address); and
- ☐ New signed certification statement.

---

Signature of [Authorized Representative of] Legally  
Responsible Person or Duly Authorized  
Representative

---

Date

---

Name of [Authorized Representative of] Legally  
Responsible Person or Duly Authorized  
Representative

---

Telephone Number

## **Appendix E:      Construction Schedule**

---

## Appendix F: Construction Activities, Materials Used, and Associated Pollutants

**Table F.a POLLUTANTS ASSOCIATED WITH CONSTRUCTION ACTIVITIES**

General Work Activity/ Products With Potential Stormwater Pollutants	Specific Work Activity/Products With Potential Stormwater Pollutants	Pollutant Categories
Adhesives	<ul style="list-style-type: none"> <li>Adhesives, glues, resins, epoxy synthetics, PVC cement</li> <li>Caulks, sealers, putty, sealing agents and</li> <li>Coal tars (naphtha, pitch)</li> </ul>	Oil and Grease, Synthetic Organics
Asphalt paving/curbs	<ul style="list-style-type: none"> <li>Hot and cold mix asphalt</li> </ul>	Oil and Grease
Cleaners	<ul style="list-style-type: none"> <li>Polishes (metal, ceramic, tile)</li> <li>Etching agents</li> <li>Cleaners, ammonia, lye, caustic sodas, bleaching agents and chromate salts</li> </ul>	Metals, Synthetic Organics
Concrete / Masonry	<ul style="list-style-type: none"> <li>Cement and brick dust</li> <li>Colored chalks</li> <li>Concrete curing compounds</li> <li>Glazing compounds</li> <li>Surfaces cleaners</li> <li>Saw cut slurries</li> <li>Tile cutting</li> </ul>	Metals, Synthetic Organics
Drywall	<ul style="list-style-type: none"> <li>Saw-cutting drywall</li> </ul>	Metals
Framing/Carpentry	<ul style="list-style-type: none"> <li>Sawdust, particle board dust, and treated woods</li> <li>Saw cut slurries</li> </ul>	Metals, Synthetic Organics
Heating, Ventilation, Air Conditioning	<ul style="list-style-type: none"> <li>Demolition or construction of air condition and heating systems</li> </ul>	Metals, Synthetic Organics
Insulation	<ul style="list-style-type: none"> <li>Demolition or construction involving insulation, venting systems</li> </ul>	Metals, Synthetic Organics
Liquid waste	<ul style="list-style-type: none"> <li>Wash waters</li> <li>Irrigation line testing/flushing</li> </ul>	Metals, Synthetic Organics
Painting	<ul style="list-style-type: none"> <li>Paint thinners, acetone, methyl ethyl ketone, stripper paints, lacquers, varnish, enamels, turpentine, gum spirit, solvents, dyes, stripping pigments and sanding</li> </ul>	Metals, Synthetic Organics
Planting / Vegetation Management	<ul style="list-style-type: none"> <li>Vegetation control (pesticides/herbicides)</li> <li>Planting</li> <li>Plant maintenance</li> <li>Vegetation removal</li> </ul>	Nutrients, Metals, Synthetic Organics
Plumbing	<ul style="list-style-type: none"> <li>Solder (lead, tin), flux (zinc chloride), pipe fitting</li> <li>Galvanized metal in nails, fences, and electric wiring</li> </ul>	Metals, Synthetic Organics

**Table F.a POLLUTANTS ASSOCIATED WITH CONSTRUCTION ACTIVITIES**

<b>General Work Activity/ Products With Potential Stormwater Pollutants</b>	<b>Specific Work Activity/Products With Potential Stormwater Pollutants</b>	<b>Pollutant Categories</b>
Removal of existing structures	<ul style="list-style-type: none"><li>• Demolition of asphalt, concrete, masonry, framing, roofing, metal structures.</li></ul>	Metals, Oil and Grease, Synthetic Organics
Roofing	<ul style="list-style-type: none"><li>• Flashing</li><li>• Saw cut slurries (tile cutting)</li><li>• Shingle scrap and debris</li></ul>	Metals, Oil and Grease, Synthetic Organics
Sanitary waste	<ul style="list-style-type: none"><li>• Portable toilets</li><li>• Disturbance of existing sewer lines.</li></ul>	Nutrients
Soil preparation/amendments	<ul style="list-style-type: none"><li>• Use of soil additives/amendments</li></ul>	Nutrients
Solid waste	<ul style="list-style-type: none"><li>• Litter, trash and debris</li><li>• Vegetation</li></ul>	Gross Pollutants
Utility line testing and flushing	<ul style="list-style-type: none"><li>• Hydrostatic test water</li><li>• Pipe flushing</li></ul>	Synthetic Organics
Vehicle and equipment use	<ul style="list-style-type: none"><li>• Equipment operation</li><li>• Equipment maintenance</li><li>• Equipment washing</li><li>• Equipment fueling</li></ul>	Oil and Grease
1 Synthetic Organics are defined in Table 1.2 of the CASQA Stormwater BMP Handbook: Construction as adhesives, cleaners, sealants, solvents, etc. These are generally categorized as VOCs or SVOCs.		



**Table F.1 Pollutant Source Assessment Form**

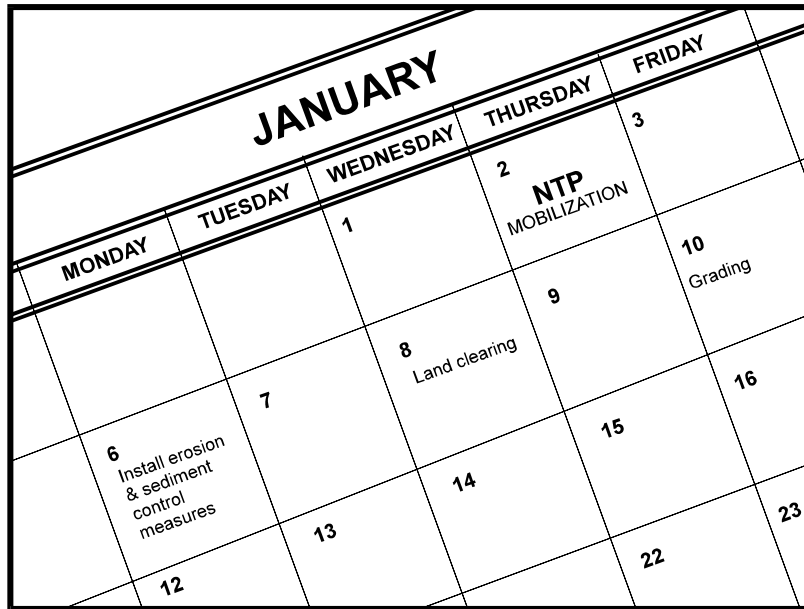
<b>Phase</b>	<b>Activity</b>	<b>Associated Materials or Pollutants</b>	<b>Pollutant Category <sup>(1)</sup></b>
Demolition and Pre-Development Site Preparation Phase	Geotechnical investigations	Sediment	TSS
	Vehicle Equipment Operation and Storage	Fuel, Oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	Concrete cutting/grinding	sediment, concrete dust and slurry	Sediment, pH, metals
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
Grading and Land Development	Grading	Sediment	Sediment
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
Streets and Utilities Phase	Material Delivery	Varies based on materials	Varies based on materials
	Trenching and Soil Management	Sediment	Sediment
	Install pipelines, laterals, conduits	Joint and form lubricants, PVC shards/dust	Synthetic organics, gross Pollutants
	Adhesives	Adhesives, flues, resins, epoxy synthetic, PVC cement Caulks, sealers, putty, sealing agents.	Oil & grease, synthetic organics
	Asphalt Concrete Paving Operations	Sediment, bituminous chemicals	Sediment, oil & grease
	Concrete Paving and Operations	Curing Concrete, Concrete washout waste	Sediment, metals, pH
	Install emulsion sealer	Hydrocarbons	Oil & grease
	Paint pavement striping and markings	Paint	Synthetic organics, nutrients
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses

	Utility line flushing	Chlorinated water	Synthetic organics
Vertical Construction Phase	Welding	Solder (lead, tin), flux (zinc chloride), pipe fitting	Metals, synthetic organics
	Framing/Carpentry	Sawdust, particle board dust, and treated woods	Metals, synthetic organics
	Drywall	Saw-cutting drywall	Metals
	Heating, ventilation, Air conditioning	Construction of HVAC systems	Metals, synthetic organics, oil and grease
	Insulation Installation	Insulation materials	Metals, synthetic organics
	Painting	Paint thinners, acetone, methyl ethyl ketone, stripper paints, lacquers, varnish, enamels, turpentine, gum spirit, solvents, dyes, stripping pigments and sanding	Metals, Synthetic Organics
	Roofing	Flashing, saw cut slurries (tiles), Shingle scrap and debris, roof sealants	Metals, oil and grease, synthetic organics
	Plumbing	Solder (lead, tin), flux (zinc chloride),	Metals
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
	Utility line flushing	Chlorinated water	Synthetic organics
Final Landscaping and Site Stabilization Phase	Planting / Vegetation Management	Vegetation control (pesticides/herbicides), planting, plant maintenance, vegetation removal	Nutrients, Metals, Synthetic Organics
	Soil preparation/amendments	Use of compost, chemical fertilizer, pH soil amendments	Nutrients, pH
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses

<sup>(1)</sup> Categories per CASQA BMP Handbook (i.e., Sediment, Nutrients, Bacteria and Viruses, Oil and Grease, Metals, Synthetic Organics, Pesticides, Gross Pollutants, and Vector Production).

## **Appendix G: CASQA Stormwater BMP Handbook: Construction Fact Sheets**

---



## Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

## Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

## Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

## Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year-round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year-round and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.
- Avoid soil disturbance during periods with high wind velocities.

## Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques

should be compared with the other less effective erosion and sedimentation controls to achieve a cost-effective balance.

## **Inspection and Maintenance**

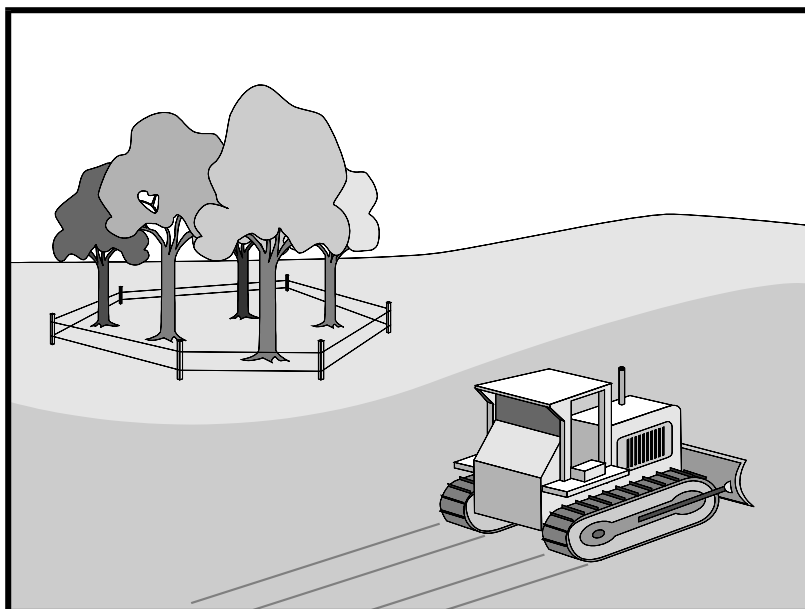
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

## **References**

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

# Preservation of Existing Vegetation EC-2



## Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

## Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.
- Protecting existing vegetation buffers and swales.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Objective
- ☐ Secondary Objective

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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# Preservation of Existing Vegetation EC-2

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## Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

## Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

## Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

## Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.



# Preservation of Existing Vegetation EC-2

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- Consider pruning or mowing vegetation instead of removing it to allow for regrowth.
- If possible, retain vegetation buffer around the site and adjacent waterways.

## Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of \$10,000 per tree.

## Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a tree's root zone by punching holes 12 in. deep with an iron bar and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization:

# Preservation of Existing Vegetation EC-2

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- Fertilize trees in the late fall or early spring. Although to note, many native species do not require fertilization.
- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.
- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

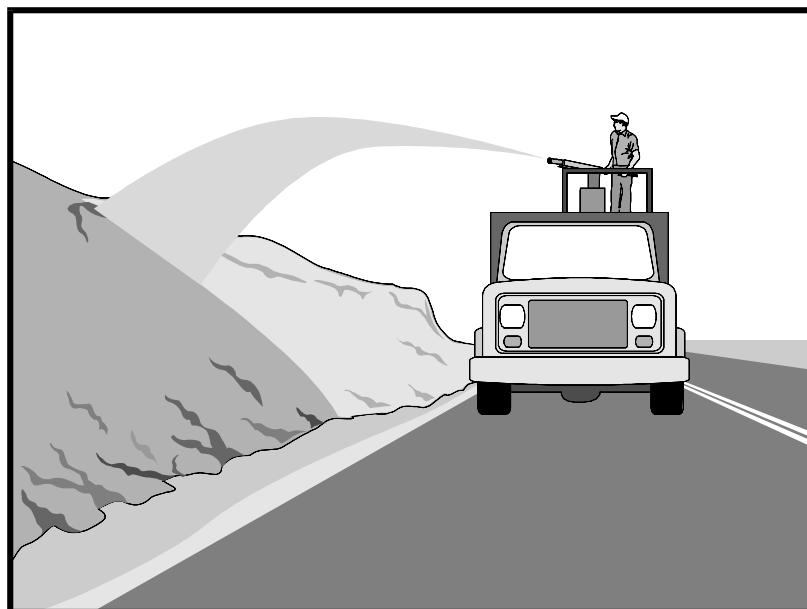
## References

County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



## Description and Purpose

Hydraulic Mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

## Suitable Applications

Hydraulic mulch as a temporary, stand alone, erosion control BMP is suitable for disturbed areas that require temporary protection from wind and water erosion until permanent soil stabilization activities commence. Examples include:

- Rough-graded areas that will remain inactive for longer than permit-required thresholds (e.g., 14 days) or otherwise require stabilization to minimize erosion or prevent sediment discharges.
- Soil stockpiles.
- Slopes with exposed soil between existing vegetation such as trees or shrubs.
- Slopes planted with live, container-grown vegetation or plugs.
- Slopes burned by wildfire.
- To stabilize earthen berms
- Areas seeded by broadcasting or drilling

## Categories

<b>EC</b>	Erosion Control	<input checked="" type="checkbox"/>
<b>SE</b>	Sediment Control	
<b>TC</b>	Tracking Control	
<b>WE</b>	Wind Erosion Control	<input checked="" type="checkbox"/>
<b>NS</b>	Non-Stormwater Management Control	
<b>WM</b>	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching
- EC-14 Compost Blanket
- EC-16 Non-Vegetative Stabilization

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- Temporary stabilization during high wind conditions

Hydraulic mulch can also be applied to augment other erosion control BMPs such as:

- In conjunction with straw mulch (see EC-6 Straw Mulch) where the rate of hydraulic mulch is reduced to 100-500 lbs per acre and the slurry is applied over the straw as a tackifying agent to hold the straw in place.
- Supplemental application of soil amendments, such as fertilizer, lime, gypsum, soil bio-stimulants or compost.

### Limitations

In general, hydraulic mulch is not limited by slope length, gradient or soil type. However, the following limitations typically apply:

- Most hydraulic mulch applications, particularly bonded fiber matrices (BFMs), require at least 24 hours to dry before rainfall occurs.
- Temporary applications (i.e., without a vegetative component) may require a second application in order to remain effective for an entire rainy season.
- Treatment areas must be accessible to hydraulic mulching equipment.
- Availability of water sources in remote areas for mixing and application.
- As a stand-alone temporary BMP, hydraulic mulches may need to be re-applied to maintain their erosion control effectiveness, typically after 6-12 months depending on the type of mulch used.
- Availability of hydraulic mulching equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Cellulose fiber mulches alone may not perform well on steep slopes or in coarse soils.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, compost, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown, and some may have water quality impacts due to their chemical makeup. Refer to specific chemical properties identified in the product Safety Data Sheet (may not include ecological information); products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.
- A water supply is needed to refill hydro mulch equipment tank.
- Cannot be disturbed by walking or driving on the surface after application.
- Recommend using in conjunction with other BMPs (i.e., fiber rolls, etc.).

## Implementation

- Where feasible, it is preferable to prepare soil surfaces prior to application by roughening embankments and fill areas with a crimping or punching type roller or by track walking.
- The majority of hydraulic mulch applications do not necessarily require surface/soil preparation (See EC-15 Soil Preparation) although in almost every case where re-vegetation is included as part of the practice, soil preparation can be beneficial. One of the advantages of hydraulic mulch over other erosion control methods is that it can be applied in areas where soil preparation is precluded by site conditions, such as steep slopes, rocky soils, or inaccessibility.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Hydraulic mulching is generally performed utilizing specialized machines that have a large water-holding/mixing tank and some form of mechanical agitation or other recirculation method to keep water, mulch and soil amendments in suspension. The mixed hydraulic slurry can be applied from a tower sprayer on top of the machine or by extending a hose to areas remote from the machine.
- Where possible apply hydraulic mulch from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage and failure of the BMP.
- Hydraulic mulch can also include a vegetative component, such as seed, rhizomes, or stolons (see EC-4 Hydraulic Seed).
- Typical hydraulic mulch application rates range from 2,000 pounds per acre for standard mulches (SMs) to 3,500 lbs. per acre for BFMs. However, the required amount of hydraulic mulch to provide adequate coverage of exposed topsoil may appear to exceed the standard rates when the roughness of the soil surface is changed due to soil preparation methods (see EC-15 Soil Preparation) or by slope gradient.
- Other factors such as existing soil moisture and soil texture can have a profound effect on the amount of hydraulic mulch required (i.e. application rate) applied to achieve an erosion-resistant covering.
- Avoid use of mulch without a tackifier component, especially on slopes.
- Mulches used in the hydraulic mulch slurry can include:
  - Cellulose fiber (paper- or corn-based)
  - Wood fibers
  - Cotton
  - Synthetics
  - Compost (see EC-14, Compost Blanket)
  - Straw

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

## Categories of Hydraulic Mulches

### Standard Hydraulic Mulch (SM)

Standard hydraulic mulches are generally applied at a rate of 2,000 lbs. per acre and are manufactured containing around 5% tackifier (i.e. soil binder), usually a plant-derived guar or psyllium type. Most standard mulches are green in color derived from food-color based dyes.

### Hydraulic Matrices (HM) and Stabilized Fiber Matrices (SFM)

Hydraulic matrices and stabilized fiber matrices are slurries which contain increased levels of tackifiers/soil binders; usually 10% or more by weight. HMs and SFMs have improved performance compared to a standard hydraulic mulch (SM) because of the additional percentage of tackifier and because of their higher application rates, typically 2,500 – 4,000 lbs. per acre. Hydraulic matrices can include a mixture of fibers, for example, a 50/50 blend of paper and wood fiber. In the case of an SFM, the tackifier/soil binder is specified as a polyacrylamide (PAM).

### Bonded Fiber Matrix (BFM)

Bonded fiber matrices (BFMs) are hydraulically-applied systems of fibers, adhesives (typically guar- or polymer-based) and chemical cross-links. Upon drying, the slurry forms an erosion-resistant blanket that prevents soil erosion and promotes vegetation establishment. The cross-linked adhesive in the BFM should be biodegradable and should not dissolve or disperse upon re-wetting. BFMs are typically applied at rates from 3,000 to 4,000 lbs. per acre based on the manufacturer's recommendation. BFMs should not be applied immediately before, during or immediately after rainfall or if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

### Hydraulic Compost Matrix (HCM)

Hydraulic compost matrix (HCM) is a field-derived practice whereby finely graded or sifted compost is introduced into the hydraulic mulch slurry. A guar-type tackifier can be added for steeper slope applications as well as any specified seed mixtures. An HCM can help to accelerate seed germination and growth. HCMs are particularly useful as an in-fill for three-dimensional re-vegetation geocomposites, such as turf reinforcement mats (TRM) (see EC-7 Geotextiles and Mats).

## Costs

Average installed costs for hydraulic mulch categories are provided in Table 1, below.

**Table**  
**HYDRAULIC MULCH BMPs**  
**INSTALLED COSTS**

BMP	Installed Cost/Acre
Standard Hydraulic Mulching (SM)	\$2,100 - \$4,700 per acre
Hydraulic Matrices (HM) and Stabilized Fiber Matrices	
Guar-based	\$2,600 - \$5,200 per acre
PAM-based	\$3,200 - \$7,200 per acre
Bonded Fiber Matrix (BFM)	\$5,000 - \$8,800 per acre
Hydraulic Compost Matrix (HCM)	\$3,800 - \$4,500 per acre

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

## Inspection and Maintenance

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Compare the number of bags or weight of applied mulch to the area treated to determine actual application rates and compliance with specifications.

## References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Controlling Erosion of Construction Sites, Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, an Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

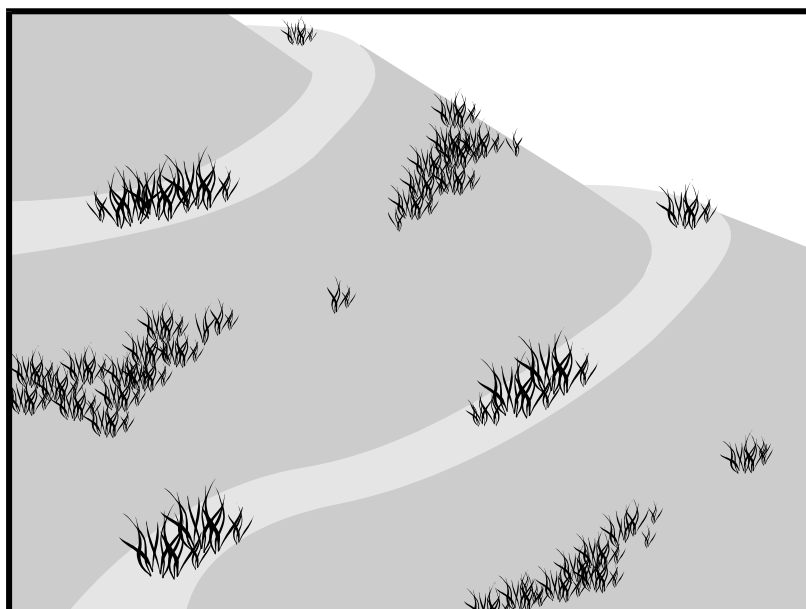
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.





## Description and Purpose

Hydroseeding typically consists of applying a mixture of a hydraulic mulch, seed, and water with the possible addition of tackifier, compost, mycorrhizae inoculant, fertilizer, and/or soil conditioner, to temporarily protect exposed soils from erosion by water and wind. Hydraulic seeding, or hydroseeding, is simply the method by which temporary or permanent seed is applied to the soil surface and temporary erosion control is established by means of the mulch component.

## Suitable Applications

Hydroseeding is suitable for disturbed areas requiring temporary protection until permanent stabilization is established, for disturbed areas that will be re-disturbed following an extended period of inactivity, or to apply permanent stabilization measures. Hydroseeding without mulch or other cover (e.g., EC-7, Geotextiles and Mats) is not a stand-alone erosion control BMP and should be combined with additional measures until vegetation establishment.

Typical applications for hydroseeding include:

- Disturbed soil/graded areas where permanent stabilization or continued earthwork is not anticipated prior to seed germination.
- Cleared and graded areas exposed to seasonal rains or temporary irrigation.
- To vegetate swales and earthen berms.

## Categories

<b>EC</b>	Erosion Control	<input checked="" type="checkbox"/>
<b>SE</b>	Sediment Control	
<b>TC</b>	Tracking Control	
<b>WE</b>	Wind Erosion Control	<input checked="" type="checkbox"/>
<b>NS</b>	Non-Stormwater Management Control	
<b>WM</b>	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching
- EC-14 Compost Blanket
- EC-16 Non-Vegetative Stabilization

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- Areas not subject to heavy wear by construction equipment or high traffic.

## Limitations

- Availability of hydroseeding equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Hydraulic seed should be applied with hydraulic mulch or a stand-alone hydroseed application should be followed by one of the following:
  - Straw mulch (see Straw Mulch EC-6)
  - Rolled erosion control products (see Geotextiles and Mats EC-7)
  - Application of Compost Blanket (see Compost Blanket EC-14)

Hydraulic seed may be used alone only on small flat surfaces when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control.

- Hydraulic seed without mulch does not provide immediate erosion control.
- Temporary seeding may not be appropriate for steep slopes (i.e., slopes readily prone to rill erosion or without sufficient topsoil).
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation may not be appropriate for short term inactivity (i.e., less than 3-6 months).
- Vegetation may not establish when hydroseed is applied to very compact soils.
- Mulch may inhibit germination when applied at high rates.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown, and some may have water quality impacts due to their chemical makeup. Additionally, these constituents may require non-visible pollutant monitoring. Refer to specific chemical properties identified in the product's Safety Data Sheet (SDS), although, note that not all SDS's provide ecological information; products should be evaluated for project-specific implementation by the QSD. Refer to fact sheet EC-05, Soil Binders, for further guidance on selecting soil binders.

## Implementation

In order to select appropriate hydraulic seed mixtures, an evaluation of site conditions should be performed with respect to:

- Soil conditions
- Site topography and exposure (sun/wind)
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS), Resource Conservation Districts and Agricultural Extension Service can provide information on appropriate seed mixes.

The following steps should be followed for implementation:

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying (See EC-15, Soil Preparation) the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.
- Avoid use of hydraulic seed in areas where the BMP would be incompatible with future earthwork activities.
- Hydraulic seed can be applied using a multiple step or one step process.
  - In a multiple step process, hydraulic seed is applied first, followed by mulch or a Rolled Erosion Control Product (RECP).
  - In the one step process, hydraulic seed is applied with hydraulic mulch in a hydraulic matrix. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.
- All hydraulically seeded areas should have mulch, or alternate erosion control cover to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds should be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag should be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container should be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed should be pellet inoculated. Inoculant sources should be species specific and should be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer should conform to the requirements of the California Food and Agricultural Code, which can be found at: [http://www.leginfo.ca.gov/.html/fac\\_table\\_of\\_contents.html](http://www.leginfo.ca.gov/.html/fac_table_of_contents.html). Fertilizer should be pelleted or granular form.
- Follow up applications should be made as needed to cover areas of poor coverage or germination/vegetation establishment and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

## Costs

Average cost for installation and maintenance may vary from as low as \$2,400 per acre for flat slopes and stable soils, to \$5,200 per acre for moderate to steep slopes and/or erosive soils. Cost of seed mixtures vary based on types of required vegetation.

BMP	Installed Cost per Acre
Hydraulic Seed	\$2,400-\$5,200

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

## Inspection and Maintenance

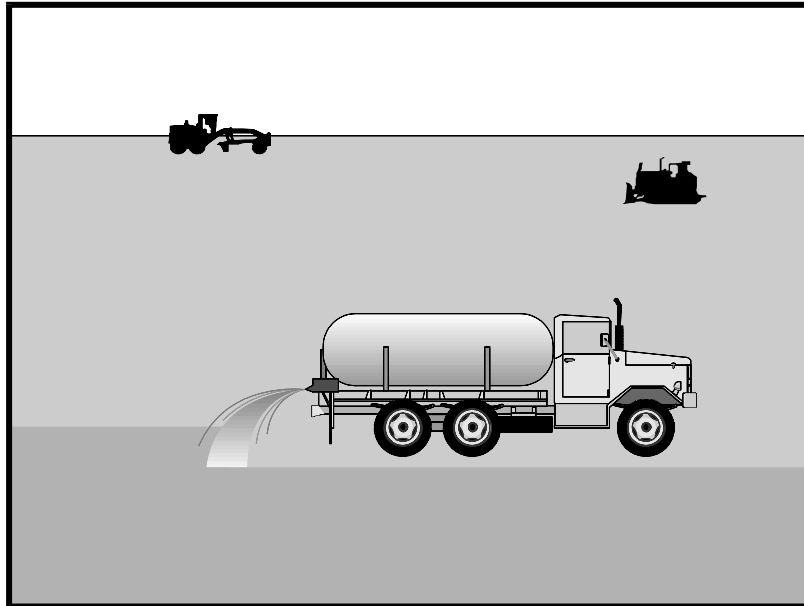
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems should be inspected for complete coverage and adjusted as needed to maintain complete coverage.

## References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.



## Description and Purpose

Soil binding consists of application and maintenance of a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites.

## Suitable Applications

Soil binders are typically applied to disturbed areas requiring temporary protection. Because soil binders, when used as a stand-alone practice, can often be incorporated into the soil, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are commonly used in the following areas:

- Rough graded soils that will be inactive for a short period of time.
- Soil stockpiles.
- Temporary haul roads prior to placement of crushed rock.
- Compacted soil road base.
- Construction staging, materials storage, and layout areas.
- Slopes and areas requiring stabilization prior to rain.
- Disturbed areas subject to high winds.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching

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## Limitations

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer. Curing time may be 24 hours or longer. Soil binders may need reapplication after a storm event.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
- Plant-material-based soil binders do not generally hold up to pedestrian or vehicular traffic across treated areas as well as polymeric emulsion blends or cementitious-based binders.
- Soil binders may not sufficiently penetrate compacted soils.
- Some soil binders are soil texture specific in terms of their effectiveness. For example, polyacrylamides (PAMs) work very well on silt and clayey soils but their performance decreases dramatically in sandy soils.
- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of some chemical soil binders are relatively unknown, and some may have water quality impacts due to their chemical makeup. Additionally, these chemicals may require non-visible pollutant monitoring. Products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to the product Material Safety Data Sheet for chemical properties.

## Implementation

### *General Considerations*

- Soil binders should conform to local municipality specifications and requirements.
- Site soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces. Soil binders should not pollute stormwater when cured. Obtain a Safety Data Sheet (SDS) from the manufacturer to ensure non-toxicity (note however, the SDS may not include ecological information).
- Stormwater runoff from PAM treated soils should pass through one of the following sediment control BMP prior to discharging to surface waters.
  - When the total drainage area is greater than or equal to 5 acres, PAM treated areas should drain to a sediment basin.

- Areas less than 5 acres should drain to sediment control BMPs, such as a sediment trap, or a series of check dams. The total number of check dams used should be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam should be spaced evenly in the drainage channel through which stormwater flows are discharged off site.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Some soil binders are designed for application to roads.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

## ***Selecting a Soil Binder***

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this Fact Sheet. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- Frequency of application - The frequency of application is related to the functional longevity of the binder, which can be affected by subgrade conditions, surface type, climate, and maintenance schedule.
- Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

## ***Plant-Material-Based (Short Lived, <6 months) Binders***

**Guar:** Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

**Application Rates for Guar Soil Stabilizer**

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	40	45	50	60	70

**Psyllium:** Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lb/acre, with enough water in solution to allow for a uniform slurry flow.

**Starch:** Starch is non-ionic, cold water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

## ***Plant-Material-Based (Long Lived, 6-12 months) Binders***

**Pitch and Rosin Emulsion:** Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should be non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

- For clayey soil: 5 parts water to 1-part emulsion
- For sandy soil: 10 parts water to 1-part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

## ***Polymeric Emulsion Blend Binders***

**Acrylic Copolymers and Polymers:** Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound typically requires 12 to 24 hours drying time. Liquid copolymer should be diluted at a rate of 10 parts water to 1-part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

**Liquid Polymers of Methacrylates and Acrylates:** This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with the manufacturer's recommendations and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.



Copolymers of Sodium Acrylates and Acrylamides: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

<b>Slope Gradient (H:V)</b>	<b>lb/acre</b>
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:1 to 1:1	10.0 – 20.0

Poly-Acrylamide (PAM) and Copolymer of Acrylamide: Linear copolymer polyacrylamide for use as a soil binder is packaged as a dry flowable solid, as a liquid. Refer to the manufacturer's recommendation for dilution and application rates as they vary based on liquid or dry form, site conditions and climate.

- Limitations specific to PAM are as follows:
  - Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
  - The specific PAM copolymer formulation must be anionic. Cationic PAM should not be used in any application because of known aquatic toxicity problems. Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, should be used for soil applications.
  - PAM designated for erosion and sediment control should be “water soluble” or “linear” or “non-cross linked”.
  - PAM should not be used as a stand-alone BMP to protect against water-based erosion. When combined with mulch, its effectiveness increases dramatically.

Hydro-Colloid Polymers: Hydro-Colloid Polymers are various combinations of dry flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

### ***Cementitious-Based Binders***

Gypsum: This is a formulated gypsum-based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86%. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

### ***Applying Soil Binders***

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd<sup>2</sup> or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically, at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd<sup>2</sup>.

## Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate installed costs:

Soil Binder	Cost per Acre
Plant-Material-Based (Short Lived) Binders	\$900-\$1,200
Plant-Material-Based (Long Lived) Binders	\$1,500-\$1,900
Polymeric Emulsion Blend Binders	\$900-\$1,900
Cementitious-Based Binders	\$1,000-\$1,500

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech Inc.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.

- Reapply the selected soil binder as needed to maintain effectiveness.

<b>Table 1 Properties of Soil Binders for Erosion Control</b>				
<b>Evaluation Criteria</b>	<b>Binder Type</b>			
	<b>Plant Material Based (Short Lived)</b>	<b>Plant Material Based (Long Lived)</b>	<b>Polymeric Emulsion Blends</b>	<b>Cementitious-Based Binders</b>
Relative Cost	Low	Moderate to High	Low to High	Low to Moderate
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies <sup>(1)</sup>	Varies <sup>(1)</sup>	Varies <sup>(1)</sup>	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

## References

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

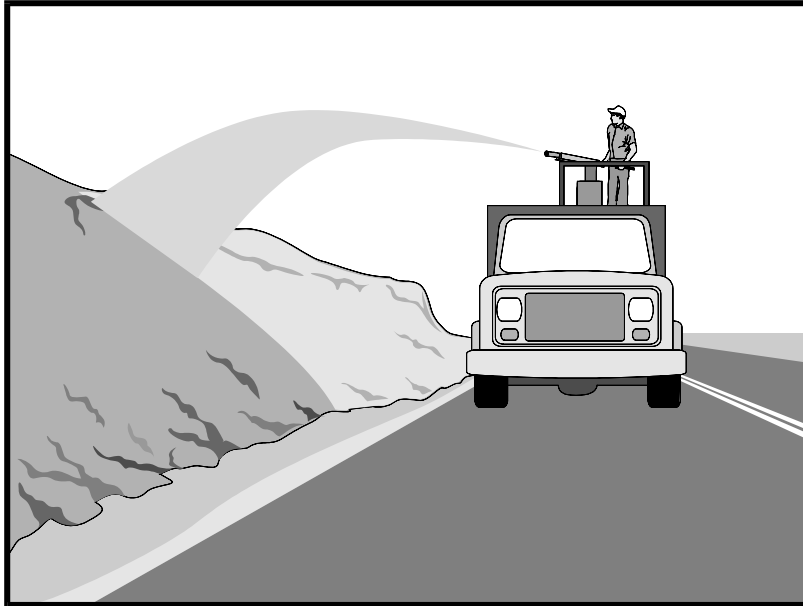
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Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

## Suitable Applications

Straw mulch is suitable for disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch can be specified for the following applications:

- As a stand-alone BMP on disturbed areas until soils can be prepared for permanent vegetation. The longevity of straw mulch is typically less than six months.
- Applied in combination with temporary seeding strategies
- Applied in combination with permanent seeding strategies to enhance plant establishment and final soil stabilization
- Applied around containerized plantings to control erosion until the plants become established to provide permanent stabilization

## Limitations

Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching
- EC-14 Compost Blanket

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- There is a potential for introduction of weed seed and unwanted plant material if weed-free agricultural straw is not specified.
- Straw mulch applied by hand is more time intensive and potentially costly.
- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- “Punching” of straw does not work in sandy soils, necessitating the use of tackifiers.
- Potential fugitive dust control issues associated with straw applications can occur. Application of a stabilizing emulsion or a water stream at the same time straw is being blown can reduce this problem.
- Use of plastic netting should be avoided in areas where wildlife may be entrapped and may be prohibited for projects in certain areas with sensitive wildlife species, especially reptiles and amphibians.

## Implementation

- Straw should be derived from weed-free wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw should be used.
- Use tackifier to anchor straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate straw mulch into the soil on slopes. Track walking can be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier should not be applied during or immediately before rainfall.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

## Application Procedures

- When using a tackifier to anchor the straw mulch, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.
- Apply straw at a rate of between 3,000 and 4,000 lb./acre, either by machine or by hand distribution and provide 100% ground cover. A lighter application is used for flat surfaces and a heavier application is used for slopes.
- Evenly distribute straw mulch on the soil surface.
- Anchoring straw mulch to the soil surface by “punching” it into the soil mechanically (incorporating) can be used in lieu of a tackifier.

- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier should be selected based on longevity and ability to hold the fibers in place. A tackifier is typically applied at a rate of 125 lb./acre. In windy conditions, the rates are typically 180 lb./acre.
  - On very small areas, a spade or shovel can be used to punch in straw mulch.
  - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coulter, known commercially as a "crimper."

## Costs

Average annual cost for installation and maintenance is included in the table below. Application by hand is more time intensive and potentially more costly.

BMP	Unit Cost per Acre
Straw mulch, crimped or punched	\$3,150-\$6,900
Straw mulch with tackifier	\$2,300-\$6,200

Source: Cost information received from individual product suppliers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives. Straw mulch as a stand-alone BMP is temporary and is not suited for long-term erosion control.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.



## References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

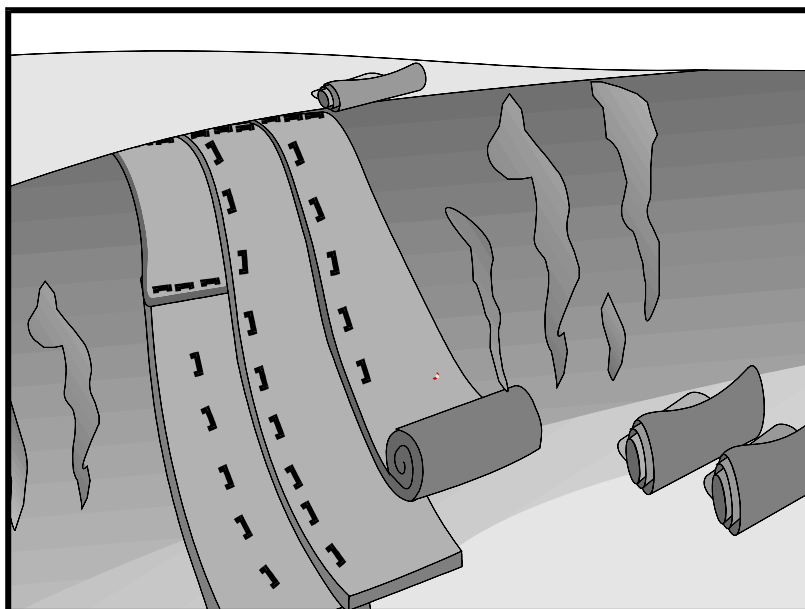
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Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



## Description and Purpose

Rolled Erosion Control Products (RECPs), also known as erosion control matting or blankets, can be made of natural or synthetic materials or a combination of the two. RECPs are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, RECPs may be used to stabilize soils until vegetation is established or to reinforce non-woody surface vegetation.

## Suitable Applications

RECPs are typically applied on slopes where erosion hazard is high, and vegetation will be slow to establish. Matting is also used on stream banks, swales and other drainage channels where moving water at velocities between 3 ft/s and 6 ft/s are likely to cause scour and wash out new vegetation and in areas where the soil surface is disturbed and where existing vegetation has been removed. RECPs may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). RECPs should be considered when the soils are fine grained and potentially erosive. RECPs should be considered in the following situations:

- Steep slopes, generally steeper than 3:1 (H:V).
- Long slopes.
- Slopes where the erosion potential is high.
- Slopes and disturbed soils where mulch must be anchored.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
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## Legend:

- ☒ **Primary Category**
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## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
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Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding

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- Disturbed areas where temporary cover is needed, or plants are slow to establish or will not establish.
- Channels with flows exceeding 3.3 ft/s.
- Channels to be vegetated.
- Stockpiles.
- Slopes adjacent to water bodies.

## Limitations

- RECP installed costs are generally higher than other erosion control BMPs, limiting their use to areas where other BMPs are ineffective (e.g., channels, steep slopes).
- RECPs may delay seed germination, due to reduction in soil temperature and/or sunlight.
- RECPs are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since staples and netting can catch in mowers). If a staple or pin cannot be driven into the soil because the underlying soil is too hard or rocky, then an alternative BMP should be selected.
- If used for temporary erosion control, RECPs should be removed and disposed of prior to application of permanent soil stabilization measures.
- The use of plastic sheeting should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until other measures, such as seeding and mulching, may be installed.
  - Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
  - Plastic sheeting results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- According to the State Water Board's *CGP Review, Issue #2*, only RECPs that either do not contain plastic netting or contain netting manufactured from 100% biodegradable non-plastic materials, such as jute, sisal, or coir fiber should be used due to plastic pollution and wildlife concerns. If a plastic-netted product is used for temporary stabilization, it must be promptly removed when no longer needed and removed or replaced with non-plastic netted RECPs for final stabilization.
- RECPs may have limitations based on soil type, slope gradient, or channel flow rate; consult the manufacturer for proper selection.
- Not suitable for areas that have foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.
- RECPs that incorporate a plastic netting (e.g. straw blanket typically uses a plastic netting to hold the straw in place) may not be suitable near known wildlife habitat. Wildlife can become trapped in the plastic netting. As per State Water Board guidance, RECPs that

contain plastic netting are discouraged for temporary controls and are not acceptable alternatives for permanent controls. RECPs that do not contain plastic netting or contain netting manufactured from 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber should be used.

- RECPs may have limitations in extremely windy climates; they are susceptible to wind damage and displacement. However, when RECPs are properly trenched at the top and bottom and stapled in accordance with the manufacturer's recommendations, problems with wind can be minimized.

## **Implementation**

### **Material Selection**

- Natural RECPs have been found to be effective where re-vegetation will be provided by re-seeding. The choice of material should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.
- The following natural and synthetic RECPs are commonly used:

### **Geotextiles**

- Material can be a woven or a non-woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately  $0.07 \text{ sec}^{-1}$  in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11-gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Geotextiles may be reused if they are suitable for the use intended.

### **Plastic Covers**

- Generally plastic sheeting should only be used as stockpile covering or for very small graded areas for short periods of time (such as through one imminent storm event). If plastic sheeting must be used, choose a plastic that will withstand photo degradation.
- Plastic sheeting should have a minimum thickness of 6 mils and must be keyed in at the top of slope (when used as a temporary slope protection) and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil (when used as a temporary slope protection).
- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired

immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

## ***Erosion Control Blankets/Mats***

- Biodegradable RECPs are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order for an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable. See typical installation details at the end of this fact sheet.
- **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. The performance of jute as a stand-alone RECP is low. Most other RECPs outperform jute as a temporary erosion control product and therefore jute is not commonly used. It is designed to be used in conjunction with vegetation. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd<sup>2</sup>,  $\pm 10$  percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples should be made of minimum 11-gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd<sup>2</sup>. Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11-gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5

lb/yd<sup>2</sup>. Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11-gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Coconut fiber mesh** is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd<sup>2</sup>. Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11-gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well. Only biodegradable RECPs can remain on a site applying for a Notice of Termination due to plastic pollution and wild life concerns (State Waterboard, 2016). RECPs containing plastic that are used on a site must be disposed of for final stabilization.
- **Plastic netting** is a lightweight biaxially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Plastic mesh** is an open weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than 1/4 in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three-dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.
- **Bonded synthetic fibers** consist of a three-dimensional geometric nylon (or other synthetic) matting. Typically, it has more than 90 percent open area, which facilitates

root growth. It's tough root reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high strength continuous filament geomatrix or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

## ***Site Preparation***

- Proper soil preparation is essential to ensure complete contact of the RECP with the soil. Soil Roughening is not recommended in areas where RECPs will be installed.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 2 to 3 in. of topsoil.

## ***Seeding/Planting***

Seed the area before blanket installation for erosion control and re-vegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all areas disturbed during blanket installation must be re-seeded. Where soil filling is specified for turf reinforcement mats (TRMs), seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

## ***Check Slots***

Check slots shall be installed as required by the manufacturer.

## ***Laying and Securing Matting***

- Before laying the matting, all check slots should be installed and the seedbed should be friable, made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

## ***Anchoring***

- U-shaped wire staples, metal geotextile stake pins, or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Wire staples should be made of minimum 11-gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

## ***Installation on Slopes***

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 2 to 3 in. and staple every 3 ft (or greater, per manufacturer's specifications).
- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd<sup>2</sup>. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 1/2 staples/yd<sup>2</sup>. Check manufacturer's specifications to determine if a higher density staple pattern is required.

## ***Installation in Channels***

Installation should be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft intervals along the channels.
- Cut longitudinal channel anchor trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 to 3 in. above the crest of the channel side slopes.



- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 12 in. intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 3 in.
- Secure these initial ends of mats with anchors at 12 in. intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 3 in. overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 12 in. intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 6 in. centers at 25 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 12 in. intervals.
- Place edges of outside mats in previously excavated longitudinal slots; anchor using prescribed staple pattern, backfill, and compact soil.
- Anchor, fill, and compact upstream end of mat in a 12 in. by 6 in. terminal trench.
- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

### ***Soil Filling (if specified for turf reinforcement mat (TRM))***

Installation should be in accordance with the manufacturer's recommendations. Typical installation guidelines are as follows:

- After seeding, spread and lightly rake 1/2-3/4 inches of fine topsoil into the TRM apertures to completely fill TRM thickness. Use backside of rake or other flat implement.
- Alternatively, if allowed by product specifications, spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment.
- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes, or brooms for fine grading and touch up.
- Smooth out soil filling just exposing top netting of mat.

## ***Temporary Soil Stabilization Removal***

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

## **Costs**

Installed costs can be relatively high compared to other BMPs. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre
Biodegradable	Jute Mesh	\$7,700-\$9,000
	Curled Wood Fiber	\$10,200-\$13,400
	Straw	\$10,200-\$13,400
	Wood Fiber	\$10,200-\$13,400
	Coconut Fiber	\$16,600-\$18,000
	Coconut Fiber Mesh	\$38,400-\$42,200
	Straw Coconut Fiber	\$12,800-\$15,400
Non-Biodegradable	Plastic Netting	\$2,600-\$2,800
	Plastic Mesh	\$3,800-\$4,500
	Synthetic Fiber with Netting	\$43,500-\$51,200
	Bonded Synthetic Fibers	\$57,600-\$70,400
	Combination with Biodegradable	\$38,400-\$46,100

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

## ***Inspection and Maintenance***

- RECPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.

## References

CGP Review #2, State Water Resources Control Board, 2014. Available online at: [http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/docs/training/cgp\\_review\\_issue2.pdf](http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/training/cgp_review_issue2.pdf).

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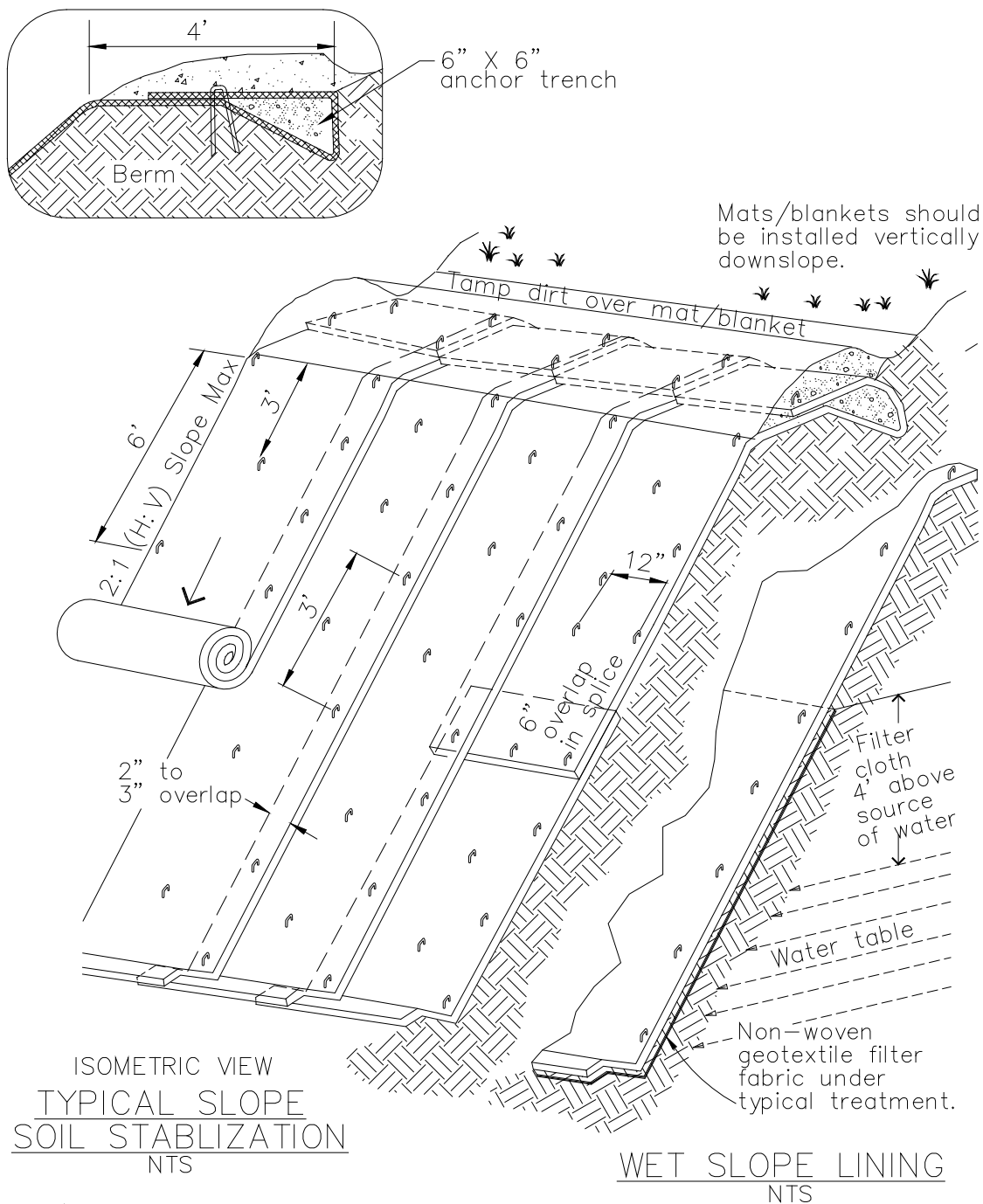
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Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

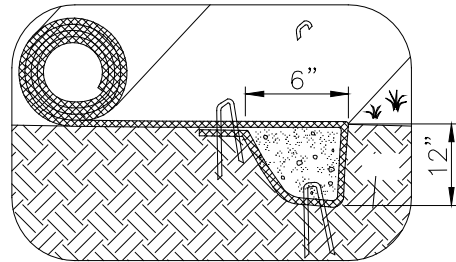
Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



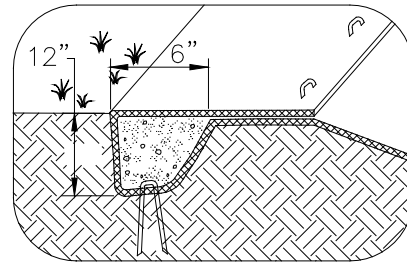
## NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

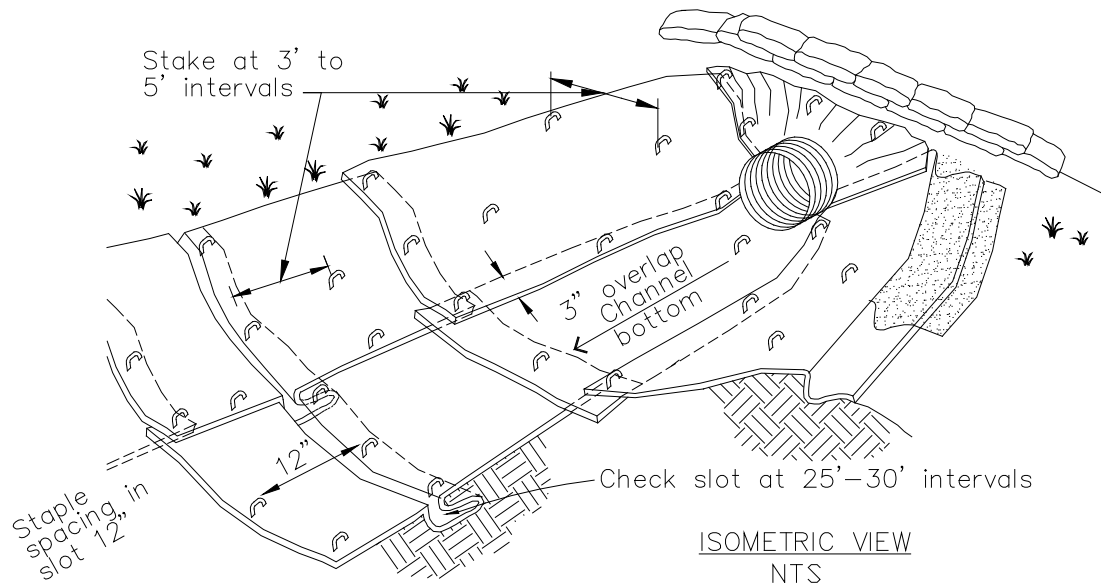
## TYPICAL INSTALLATION DETAIL



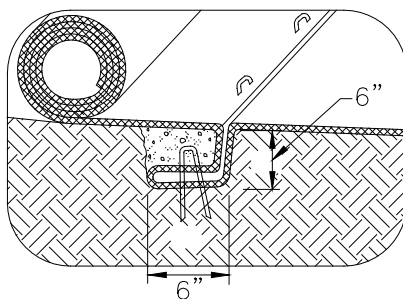
INITIAL CHANNEL ANCHOR TRENCH  
NTS



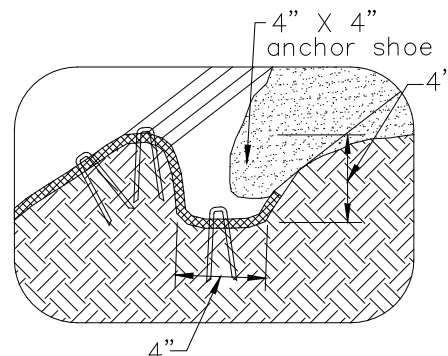
TERMINAL SLOPE AND CHANNEL  
ANCHOR TRENCH  
NTS



ISOMETRIC VIEW  
NTS



INTERMITTENT CHECK SLOT  
NTS



LONGITUDINAL ANCHOR TRENCH  
NTS

## NOTES:

1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

## TYPICAL INSTALLATION DETAIL



## Description and Purpose

Wood mulching consists of applying a mixture of shredded wood mulch or bark to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

## Suitable Applications

Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established. Wood mulch may also be used for final stabilization; generally, used in a landscape setting or areas that will have pedestrian traffic.

## Limitations

- Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter. Not suitable for use on slopes steeper than 3:1 (H:V). For slopes steeper than 3:1, consider the use of Compost Blankets (EC-14).
- Wood mulch may introduce unwanted species if it contains seed, although it may also be used to prevent weed growth if it is seed-free.
- Not suitable for areas exposed to concentrated flows.
- If used for temporary stabilization, wood mulch may need to be removed prior to further earthwork.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats

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## Implementation

### *Mulch Selection*

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

### *Application Procedures*

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such as a punching type roller or by track walking. The construction application procedures for mulches vary significantly depending upon the type of mulching method specified. Two methods are highlighted here:

- **Green Material:** This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Chipped brush from on-site vegetation clearing activities may be used (this may require stockpiling and reapplying after earthwork is complete). Methods of application are generally by hand although pneumatic methods are available.
  - Green material can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 2 in.
- **Shredded Wood:** Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable. See note under limitations.
  - Distribute by hand or use pneumatic methods.
  - Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.
- Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation, etc.

## Costs

Assuming a 2-in. layer of wholesale landscaping-grade wood mulch, the average one-time cost for installation may range from \$15,000 – \$23,000 per acre<sup>1</sup>. Costs can increase if the source is not close to the project site.

## Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

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<sup>1</sup> Costs based on estimates provided by the California Department of Transportation's *Soil Stabilization BMP Research for Erosion and Sediment Controls Cost Survey Technical Memorandum*, CTSW-TM-07-172.35.1, July 2007 (available at: [http://www.dot.ca.gov/hq/LandArch/16\\_la\\_design/guidance/estimating/Soil\\_Stabilization\\_Pricing.pdf](http://www.dot.ca.gov/hq/LandArch/16_la_design/guidance/estimating/Soil_Stabilization_Pricing.pdf)) and adjusted for inflation from 1997 to 2016.

- Regardless of the mulching technique selected, the key consideration in inspection and maintenance is that the mulch needs to last long enough to achieve erosion control objectives. If the mulch is applied as a stand-alone erosion control method over disturbed areas (without seed), it should last the length of time the site will remain barren or until final re-grading and revegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance should focus on longevity and integrity of the mulch.
- Reapply mulch when bare earth becomes visible.

## References

Controlling Erosion of Construction Sites Agriculture Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

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Sedimentation and Erosion Control, An Inventory of Current Practices Draft, U.S. EPA, April 1990.

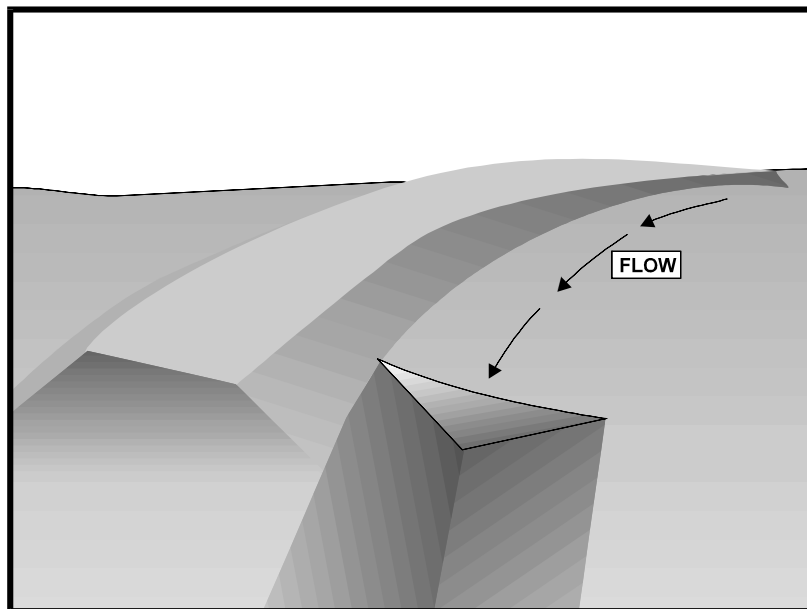
Soil Erosion by Water Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

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[http://www.dot.ca.gov/hq/LandArch/16\\_la\\_design/guidance/estimating/Soil\\_Stabilization Pricing.pdf](http://www.dot.ca.gov/hq/LandArch/16_la_design/guidance/estimating/Soil_Stabilization_Pricing.pdf).

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Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.





## Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

## Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - To intercept and divert run-on
  - Below steep grades where runoff begins to concentrate

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Along roadways and facility improvements subject to flood drainage
- At the top of slopes to divert runoff from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

## Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales, and ditches.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in drainage swales.

## Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

## **General**

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

## **Earth Dikes**

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.

- May be covered with hydro mulch, hydroseed, wood mulch, compost blanket, or RECP for stabilization.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.
- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

## ***Drainage Swales***

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost-effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft.
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 %, but not more than 15 %.

- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 % and use rip-rap or sod for swales with a slope between 5 and 15 %. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

## Costs

- Cost ranges from \$19 to \$70 per ft. for both earthwork and stabilization and depends on availability of material, site location, and access (Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.).
- Small dikes: \$3 - \$8/linear ft.; Large dikes: \$3/yd<sup>3</sup> (Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.).
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

## Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.

- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.
- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

## References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

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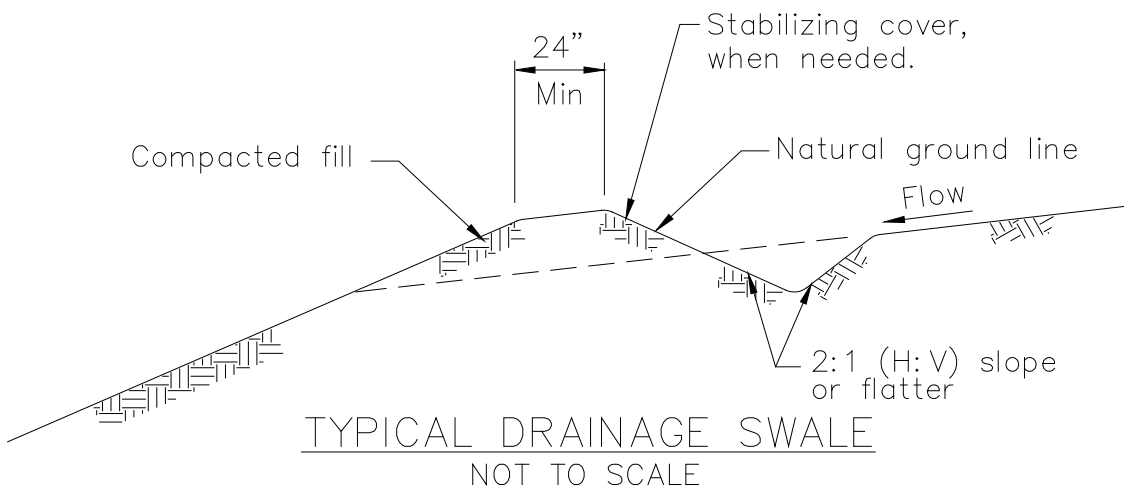
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Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

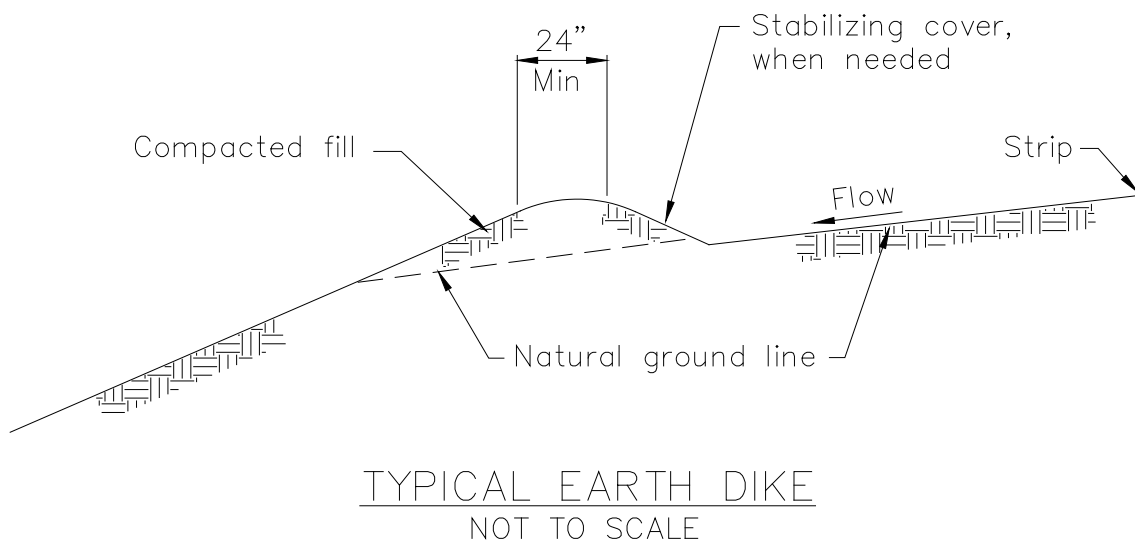
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

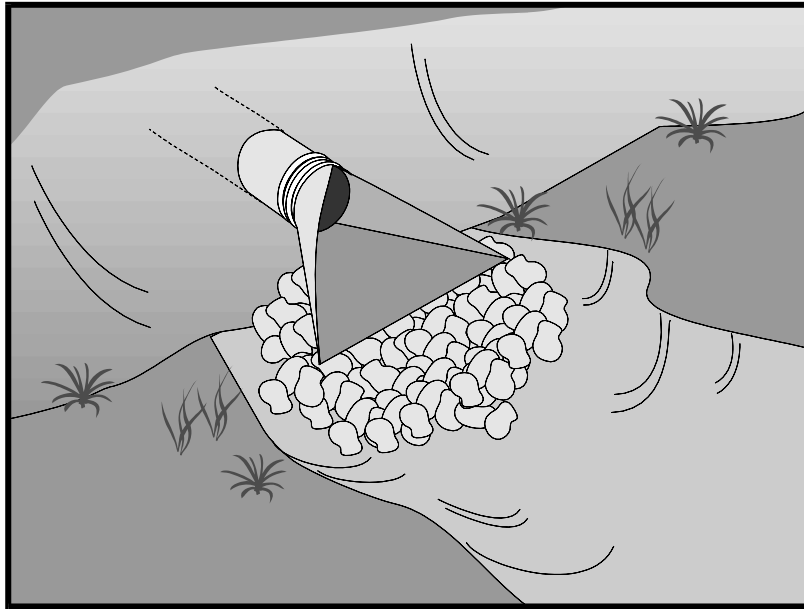
Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



## NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.





## Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

## Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runoff during construction.

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances

## Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in velocity dissipation devices.

## Implementation

### *General*

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plunge pools) and protects against gully erosion resulting from scouring at a culvert mouth.

### *Design and Layout*

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5-year flow for temporary structures planned for one rainy season, or the 10-year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.

- Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
  - Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.
  - Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the  $D_{50}$  rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.
- For proper operation of apron: Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
  - Outlets on slopes steeper than 10 percent should have additional protection.

## Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is \$250 per device.

## Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.
- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.
- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.
- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

## References

County of Sacramento Improvement Standards, Sacramento County, May 1989.

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

Handbook of Steel Drainage & Highway Construction, American Iron and Steel Institute, 1983.

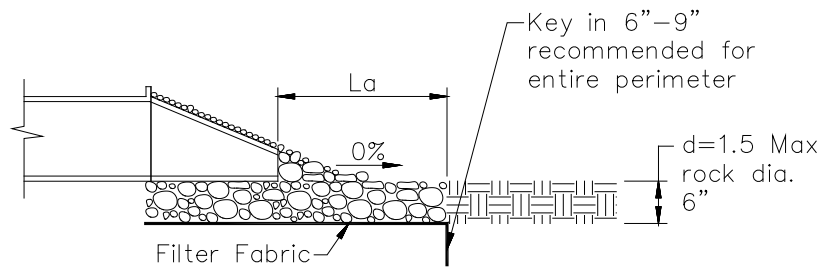
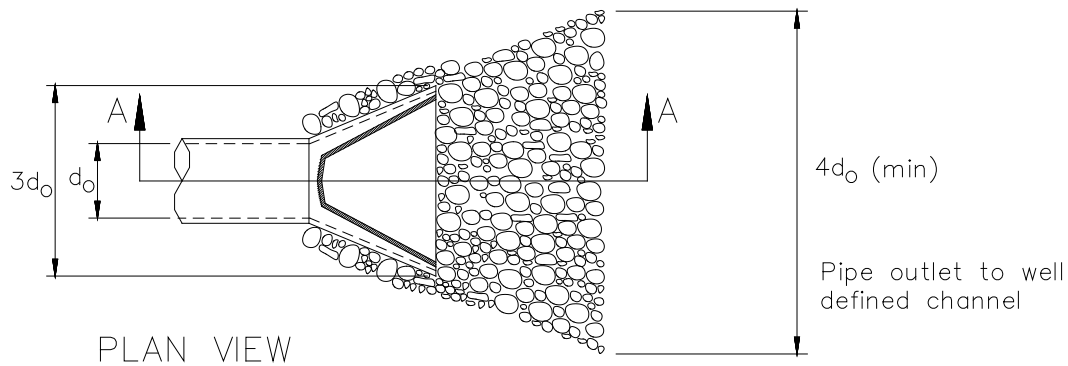
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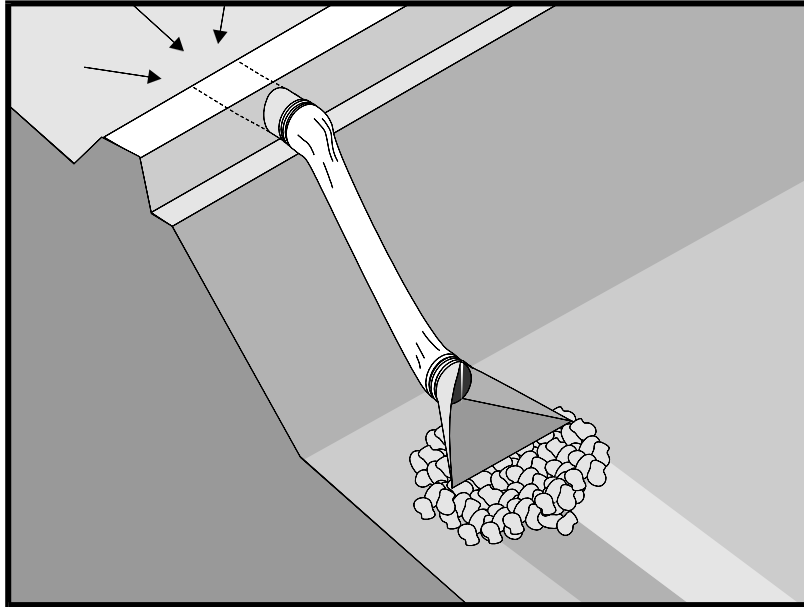
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



Pipe Diameter inches	Discharge ft <sup>3</sup> /s	Apron Length, L <sub>a</sub> ft	Rip Rap D <sub>50</sub> Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer  
Source: USDA - SCS



## Description and Purpose

A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device, or stabilized area. Slope drains are used with earth dikes and drainage ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

## Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

## Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☐ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

EC-9 Earth Dike, Drainage Swales

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- During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.
- If the sectional down drain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.
- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in energy dissipaters associated with slope drain outlets.

## Implementation

### *General*

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

### *Installation*

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.
- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.
- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.
- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.
- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.
- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.
- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.

- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.
- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.
- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.
  - Compact soil around and under entrance, outlet, and along length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.
  - Check to ensure that pipe connections are watertight.
  - Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
  - Protect outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.
  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

## ***Design and Layout***

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

### ***Materials:***

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.
- **Flexible Pipe:** The flexible pipe slope drain consists of a flexible tube of heavy-duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.
- **Section Downdrains:** The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.
- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

### **Costs**

- Cost varies based on pipe selection and selected outlet protection.



Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	\$25 per LF
15"	\$28.00
18"	\$33.00
24"	\$41.00
30"	\$64.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	\$31.00
14"	\$63.00
16"	\$65.00
18"	\$69.00
20"	\$84.00
24"	\$119.00
30"	\$166.00

Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

## Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.
- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.
- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.
- Inspect pipes for leakage. Repair leaks and restore damaged slopes.

- Inspect slope drainage for accumulations of debris and sediment.
- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.
- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

## References

Draft – Sedimentation and Erosion Control, An Inventory of Current Practices, U.S.E.P.A., April 1990.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: <http://anrcatalog.ucdavis.edu/pdf/8125.pdf>

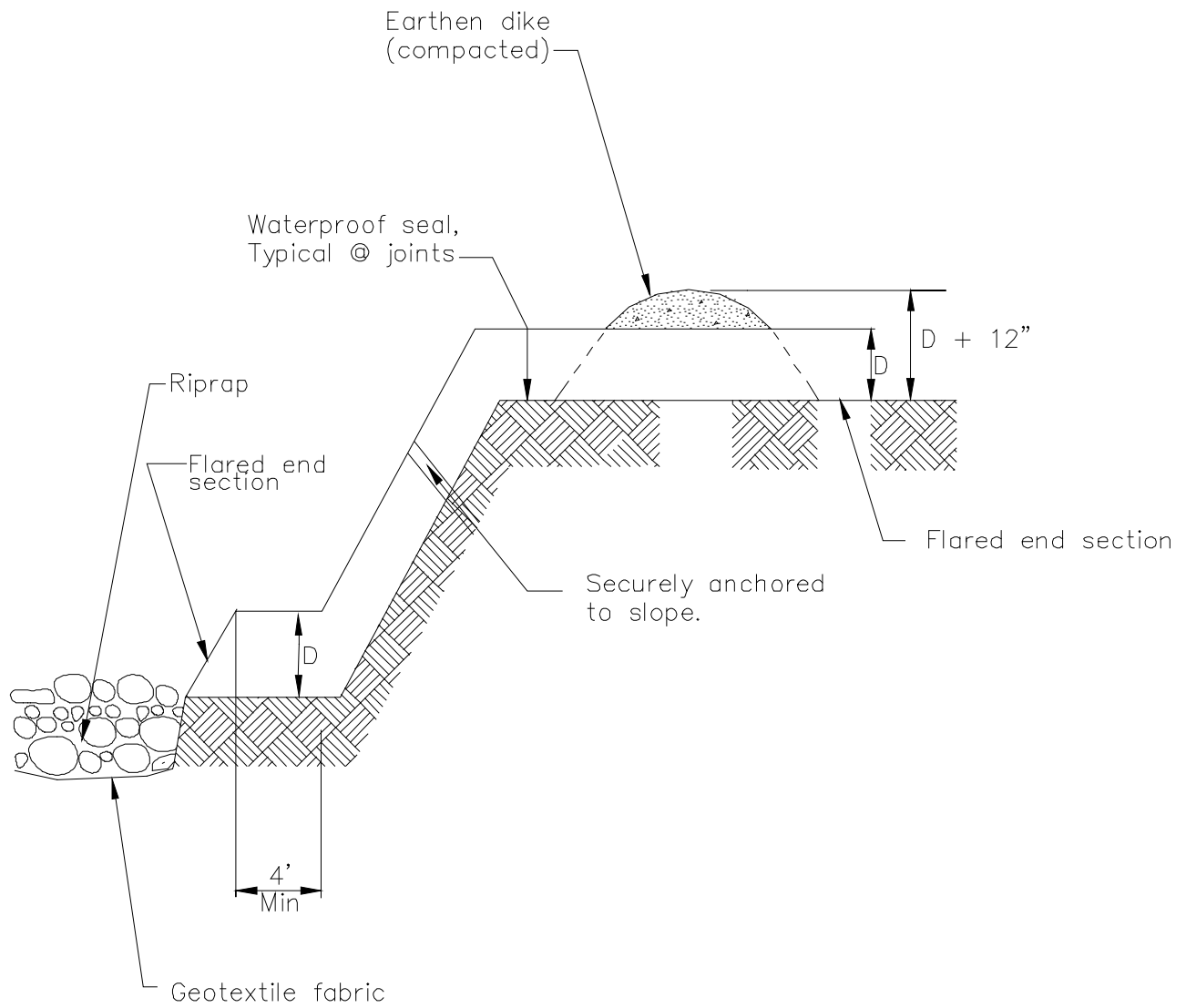
National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

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Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL SLOPE DRAIN  
NOT TO SCALE



## Description and Purpose

Stream channels, streambanks, and associated riparian areas are dynamic and sensitive ecosystems that respond to changes in land use activity. Streambank and channel disturbance resulting from construction activities can increase the stream's sediment load, which can cause channel erosion or sedimentation and have adverse affects on the biotic system. BMPs can reduce the discharge of sediment and other pollutants to minimize the impact of construction activities on watercourses. Streams on the 303(d) list and listed for sediment may require numerous measures to prevent any increases in sediment load to the stream.

## Suitable Applications

These procedures typically apply to all construction projects that disturb or occur within stream channels and their associated riparian areas.

## Limitations

Specific permit requirements or mitigation measures such as Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game supercede the guidance in this BMP.

- If numerical based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. Streams listed as 303(d) impaired for sediment, silt, or turbidity, are required to

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
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WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

Combination of erosion and sediment controls.

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conduct sampling to verify that there is no net increase in sediment load due to construction activities.

## Implementation

### *Planning*

- Proper planning, design, and construction techniques can minimize impacts normally associated with in stream construction activities. Poor planning can adversely affect soil, fish, wildlife resources, land uses, or land users. Planning should take into account: scheduling; avoidance of in-stream construction; minimizing disturbance area and construction time period; using pre-disturbed areas; selecting crossing location; and selecting equipment.

### *Scheduling*

- Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with EC-1, Scheduling. Scheduling considerations will be different when working near perennial streams vs. ephemeral streams and are as follows.
- When in-stream construction is conducted in a perennial stream, work should optimally be performed during the rainy season. This is because in the summer, any sediment-containing water that is discharged into the watercourse will cause a large change in both water clarity and water chemistry. During the rainy season, there is typically more and faster flowing water in the stream, so discharges are diluted faster. However, should in-stream work be scheduled for summer, establishing an isolation area, or diverting the stream, will significantly decrease the amount of sediment stirred up by construction work. Construction work near perennial streams should optimally be performed during the dry season (see below).
- When working in or near ephemeral streams, work should be performed during the dry season. By their very nature, ephemeral streams are usually dry in the summer, and therefore, in-stream construction activities will not cause significant water quality problems. However, when tying up the site at the end of the project, wash any fines (see Washing Fines) that accumulated in the channel back into the bed material, to decrease pollution from the first rainstorm of the season.
- When working near ephemeral or perennial streams, erosion and sediment controls (see silt fences, straw bale barriers, etc.) should be implemented to keep sediment out of stream channel.

### *Minimize Disturbance*

- Minimize disturbance through: selection of the narrowest crossing location; limiting the number of equipment trips across a stream during construction; and, minimizing the number and size of work areas (equipment staging areas and spoil storage areas). Place work areas at least 50 ft from stream channel. Field reconnaissance should be conducted during the planning stage to identify work areas.

### *Use of Pre-Disturbed Areas*

- Locate project sites and work areas in areas disturbed by prior construction or other activity when possible.

## *Selection of Project Site*

- Avoid steep and unstable banks, highly erodible or saturated soils, or highly fractured rock.
- Select project site that minimizes disturbance to aquatic species or habitat.

## *Equipment Selection*

- Select equipment that reduces the amount of pressure exerted on the ground surface, and therefore, reduces erosion potential and/or use overhead or aerial access for transporting equipment across drainage channels. Use equipment that exerts ground pressures of less than 5 or 6 lb/in<sup>2</sup>, where possible. Low ground pressure equipment includes: wide or high flotation tires (34 to 72 in. wide); dual tires; bogie axle systems; tracked machines; lightweight equipment; and, central tire inflation systems.

## **Streambank Stabilization**

### ***Preservation of Existing Vegetation***

- Preserve existing vegetation in accordance with EC-2, Preservation of Existing Vegetation. In a streambank environment, preservation of existing vegetation provides the following benefits.

### *Water Quality Protection*

- Vegetated buffers on slopes trap sediment and promote groundwater recharge. The buffer width needed to maintain water quality ranges from 15 to 100 ft. On gradual slopes, most of the filtering occurs within the first 30 ft. Steeper slopes require a greater width of vegetative buffer to provide water quality benefits.

### *Streambank Stabilization*

- The root system of riparian vegetation stabilizes streambanks by increasing tensile strength in the soil. The presence of vegetation modifies the moisture condition of slopes (infiltration, evapo transpiration, interception) and increases bank stability.

### *Riparian Habitat*

- Buffers of diverse riparian vegetation provide food and shelter for riparian and aquatic organisms. Minimizing impacts to fisheries habitat is a major concern when working near streams and rivers. Riparian vegetation provides shade, shelter, organic matter (leaf detritus and large woody debris), and other nutrients that are necessary for fish and other aquatic organisms. Buffer widths for habitat concerns are typically wider than those recommended for water quality concerns (100 to 1500 ft).
- When working near watercourses, it is important to understand the work site's placement in the watershed. Riparian vegetation in headwater streams has a greater impact on overall water quality than vegetation in downstream reaches. Preserving existing vegetation upstream is necessary to maintain water quality, minimize bank failure, and maximize riparian habitat, downstream of the work site.

### *Limitations*

- Local county and municipal ordinances regarding width, extent and type of vegetative buffer required may exceed the specifications provided here; these ordinances should be investigated prior to construction.

## *Streambank Stabilization Specific Installation*

- As a general rule, the width of a buffer strip between a road and the stream is recommended to be 50 ft plus four times the percent slope of the land, measured between the road and the top of stream bank.

## **Hydraulic Mulch**

- Apply hydraulic mulch on disturbed streambanks above mean high water level in accordance with EC-3, Hydraulic Mulch to provide temporary soil stabilization.

## *Limitations*

- Do not place hydraulic mulch or tackifiers below the mean high-water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication (eutrophication is an algal bloom caused by excessively high nutrient levels in the water).

## **Hydroseeding**

- Hydroseed disturbed streambanks in accordance with EC-4, Hydroseeding.

## *Limitations*

- Do not place tackifiers or fertilizers below the mean high-water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication.

## **Soil Binders**

- Apply soil binders to disturbed streambanks in accordance with EC-5, Soil Binders.

## *Limitations*

- Do not place soil binders below the mean high-water level. Soil binder must be environmentally benign and non-toxic to aquatic organisms.

## **Straw Mulch**

- Apply straw mulch to disturbed streambanks in accordance with EC-6, Straw Mulch.

## *Limitations*

- Do not place straw mulch below the mean high-water level, as this material could wash into the channel and impact water quality or possibly cause eutrophication.

## **Geotextiles and Mats**

- Install geotextiles and mats as described in EC-7, Geotextiles and Mats, to stabilize disturbed channels and streambanks. Not all applications should be in the channel, for example, certain geotextile netting may snag fish gills and are not appropriate in fish bearing streams. Geotextile fabrics that are not biodegradable are not appropriate for in stream use. Additionally, geotextile fabric or blankets placed in channels must be adequate to sustain anticipated hydraulic forces.

## **Earth Dikes, Drainage Swales, and Lined Ditches**

- Convey, intercept, or divert runoff from disturbed streambanks using EC-9, Earth Dikes and Drainage Swales.

## *Limitations*

- Do not place earth dikes in watercourses, as these structures are only suited for intercepting sheet flow and should not be used to intercept concentrated flow.
- Appropriately sized velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

## ***Velocity Dissipation Devices***

- Place velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with EC-10, Velocity Dissipation Devices.

## ***Slope Drains***

- Use slope drains to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area in accordance with EC-11, Slope Drains.

## *Limitations*

- Appropriately sized outlet protection and velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

## **Streambank Sediment Control**

### ***Silt Fences***

- Install silt fences in accordance with SE-1, Silt Fence, to control sediment. Silt fences should only be installed where sediment laden water can pond, thus allowing the sediment to settle out.

### ***Fiber Rolls***

- Install fiber rolls in accordance with SE-5, Fiber Rolls, along contour of slopes above the high-water level to intercept runoff, reduce flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff. In a stream environment, fiber rolls should be used in conjunction with other sediment control methods such as SE-1, Silt Fence or SE-9 Straw Bale Barrier. Install silt fence, straw bale barrier, or other erosion control method along toe of slope above the high-water level.

### ***Gravel Bag Berm***

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment laden sheet flow runoff in accordance with SE-6, Gravel Bag Berm. In a stream environment gravel bag barrier can allow sediment to settle from runoff before water leaves the construction site and can be used to isolate the work area from the live stream.

## *Limitations*

- Gravel bag barriers are not recommended as a perimeter sediment control practice around streams.

### ***Straw Bale Barrier***

- Install straw bale barriers in accordance with SE-9, Straw Bale Barrier, to control sediment. Straw bale barriers should only be installed where sediment laden water can pond, thus allowing the sediment to settle out. Install a silt fence in accordance with SE-1, Silt Fence,



on down slope side of straw bale barrier closest to stream channel to provide added sediment control.

## ***Rock Filter***

### *Description and Purpose*

Rock filters are temporary erosion control barriers composed of rock that is anchored in place. Rock filters detain the sediment laden runoff, retain the sediment, and release the water as sheet flow at a reduced velocity. Typical rock filter installations are illustrated at the end of this BMP.

### *Applications*

- Near the toe of slopes that may be subject to flow and rill erosion.

### *Limitations*

- Inappropriate for contributing drainage areas greater than 5 acres.
- Requires sufficient space for ponded water.
- Ineffective for diverting runoff because filters allow water to slowly seep through.
- Rock filter berms are difficult to remove when construction is complete.
- Unsuitable in developed areas or locations where aesthetics is a concern.

### *Specifications*

- Rock: open graded rock, 0.75 to 5 in. for concentrated flow applications.
- Woven wire sheathing: 1 in. diameter, hexagonal mesh, galvanized 20gauge (used with rock filters in areas of concentrated flow).
- In construction traffic areas, maximum rock berm heights should be 12 in. Berms should be constructed every 300 ft on slopes less than 5%, every 200 ft on slopes between 5% and 10%, and every 100 ft on slopes greater than 10%.

### *Maintenance*

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Reshape berms as needed and replace lost or dislodged rock, and filter fabric.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

## ***K-rail***

### *Description and Purpose*

This is temporary sediment control that uses K-rails to form the sediment deposition area, or to isolate the near bank construction area. Install K-rails at toe of slope in accordance with procedures described in NS-5, Clear Water Diversion.

Barriers are placed end to end in a pre-designed configuration and gravel filled bags are used at the toe of the barrier and at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

### *Appropriate Applications*

- This technique is useful at the toe of embankments, cuts or fills slopes.

### *Limitations*

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

### *Implementation*

- Refer to NS-5, Clear Water Diversion, for implementation requirements.

## **Instream Construction Sediment Control**

There are three different options currently available for reducing turbidity while working in a stream or river. The stream can be isolated from the area in which work is occurring by means of a water barrier, the stream can be diverted around the work site through a pipe or temporary channel, or one can employ construction practices that minimize sediment suspension.

Whatever technique is implemented, an important thing to remember is that dilution can sometimes be the solution. A probable “worst time” to release high TSS into a stream system might be when the stream is very low; summer low flow, for example. During these times, the flow may be low while the biological activity in the stream is very high. Conversely, the addition of high TSS or sediment during a big storm discharge might have a relatively low impact, because the stream is already turbid, and the stream energy is capable of transporting both suspended solids, and large quantities of bedload through the system. The optimum time to “pull” in-stream structures may be during the rising limb of a storm hydrograph.

### ***Techniques to minimize Total Suspended Solids (TSS)***

- **Padding** - Padding laid in the stream below the work site may trap some solids that are deposited in the stream during construction. After work is done, the padding is removed from the stream, and placed on the bank to assist in re-vegetation.
- **Clean, washed gravel** - Using clean, washed gravel decreases solid suspension, as there are fewer small particles deposited in the stream.
- **Excavation using a large bucket** - Each time a bucket of soil is placed in the stream, a portion is suspended. Approximately the same amount is suspended whether a small amount of soil is placed in the stream, or a large amount. Therefore, using a large excavator bucket instead of a small one, will reduce the total amount of soil that washes downstream.

- **Use of dozer for backfilling** - Using a dozer for backfilling instead of a backhoe follows the same principles – the fewer times soil is deposited in the stream, the less soil will be suspended.
- **Partial dewatering with a pump** - Partially dewatering a stream with a pump reduces the amount of water, and thus the amount of water that can suspend sediment.

## ***Washing Fines***

### *Definition and Purpose*

- Washing fines is an “in-channel” sediment control method, which uses water, either from a water truck or hydrant, to wash stream fines that were brought to the surface of the channel bed during restoration, back into the interstitial spaces of the gravel and cobbles.
- The purpose of this technique is to reduce or eliminate the discharge of sediment from the channel bottom during the first seasonal flow. Sediment should not be allowed into stream channels; however, occasionally in-channel restoration work will involve moving or otherwise disturbing fines (sand and silt sized particles) that are already in the stream, usually below bankfull discharge elevation. Subsequent re-watering of the channel can result in a plume of turbidity and sedimentation.
- This technique washes the fines back into the channel bed. Bedload materials, including gravel cobbles, boulders and those fines, are naturally mobilized during higher storm flows. This technique is intended to delay the discharge until the fines would naturally be mobilized.

### *Appropriate Applications*

- This technique should be used when construction work is required in channels. It is especially useful in intermittent or ephemeral streams in which work is performed “in the dry”, and which subsequently become re-watered.

### *Limitations*

- The stream must have sufficient gravel and cobble substrate composition.
- The use of this technique requires consideration of time of year and timing of expected stream flows.
- The optimum time for the use of this technique is in the fall, prior to winter flows.
- Consultation with, and approval from the Department of Fish and Game and the Regional Water Quality Control Board may be required.

### *Implementation*

- Apply sufficient water to wash fines, but not cause further erosion or runoff.
- Apply water slowly and evenly to prevent runoff and erosion.
- Consult with Department of Fish and Game and the Regional Water Quality Control Board for specific water quality requirements of applied water (e.g. chlorine).

## *Inspection and Maintenance*

- None necessary

## **Costs**

Cost may vary according to the combination of practices implemented.

## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events until final stabilization is achieved.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).

## **References**

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

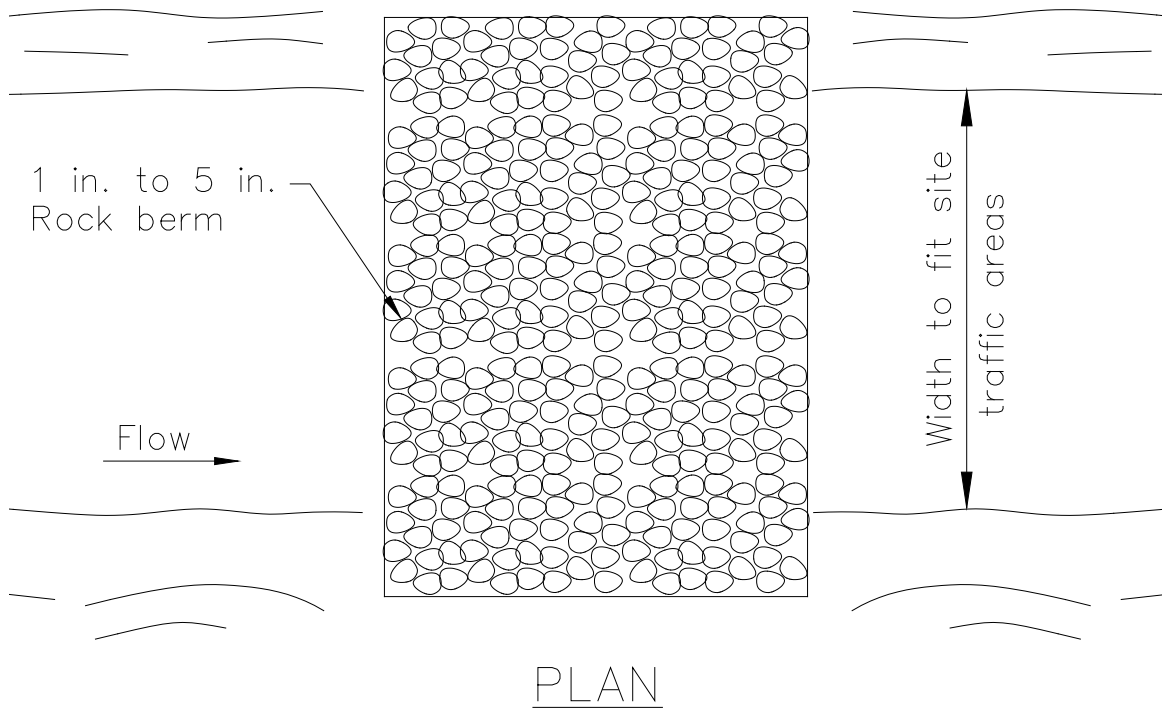
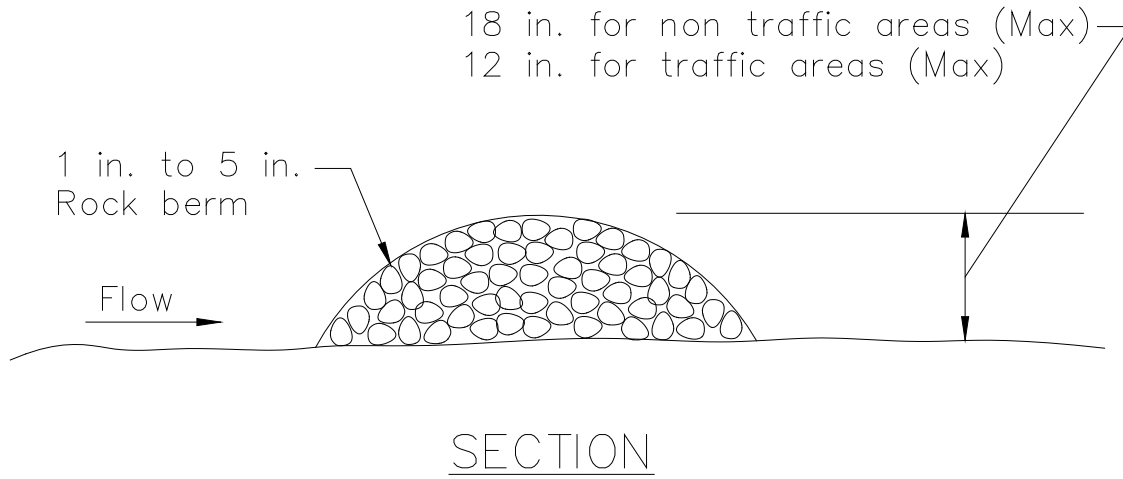
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Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



TYPICAL ROCK FILTER  
NOT TO SCALE



## Description and Purpose

A compost blanket is applied to slopes and earth disturbed areas to prevent erosion, and in some cases, increase infiltration and/or establish vegetation. The compost blanket can be applied by hand, conveyor system, compost spreader, or pneumatic delivery (blower) system. The blanket thickness is determined from the slope steepness and anticipated precipitation. A compost blanket protects the soil surface from raindrop erosion, particularly rills and gullies that may form under other methods of erosion control.

A compost blanket, if properly installed, can be very successful at vegetation establishment, weed suppression and erosion control. The compost blanket comes into direct contact with the underlying soil, reducing rill formation. Furthermore, compost provides organic matter and nutrients important for vegetation growth. The compost blanket provides soil structure that allows water to infiltrate the soil surface and retain moisture, which also promotes seed germination and vegetation growth, in addition to reducing runoff.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Green waste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly, compost selection is an important design consideration in the application of this type of erosion control.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching

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## Suitable Applications

A compost blanket is appropriate for slopes and earth disturbed areas requiring protection until permanent stabilization is established. A compost blanket can also be used in combination with temporary and/or permanent seeding strategies to enhance plant establishment. Examples include:

- Rough-graded areas that will remain inactive for longer than 14 days
- Soil stockpiles
- Slopes with exposed soil between existing vegetation such as trees or shrubs
- Slopes planted with live, container-grown vegetation
- Disturbed areas where plants are slow to develop

A compost blanket is typically used on slopes of 2:1 (H:V) or gentler. However, a compost blanket can be effective when applied to slopes as steep as 1:1 (H:V) with appropriate design considerations including slope length, blanket thickness, adding components such as a tackifier, or using compost blankets in conjunction with other techniques, such as compost socks and berms or fiber rolls.

Compost can be pre-seeded prior to application to the soil (recommended by the EPA for construction site stormwater runoff control) or seeded after the blanket has been installed. The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons (USEPA, 1998).

## Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Carefully consider the qualifications and experience of any compost producer/supplier.
- A compost blanket applied by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost-effective method of application.
- When blowers are used, the treatment areas should be within 300 ft of a road or surface capable of supporting trucks.
- Wind may limit application of compost and result in application to undesired locations.
- Compost blankets should not be applied in areas of concentrated flows.
- Steeper slopes may require additional blanket thickness and other stability measures such as using tackifiers or slope interruption devices (compost socks and berms, or fiber rolls). The same applies for sites with high precipitation totals or during the rainy season.

## Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

## *Compost Materials*

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in Table 1 below, taken from Caltrans Standard Special Provision 10-1 (SSP 10-1), Erosion Control (Compost Blanket).
- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.
- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.
- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.
- Compost should be high-quality mature compost. Immature compost can potentially leach nutrients.
- Compost should not be derived from mixed municipal solid waste and should be free of visible contaminants.
- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.
- Compost should not possess objectionable odors.
- Compost should be weed free.



Table 1. Physical/Chemical Requirements of Compost  
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	*TMECC 04.11-A Elastomeric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0–10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30–60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO <sub>2</sub> -C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inches 90–100% Passing, 1 inch 65–100% Passing, 3/4 inch 0 – 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

\*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

## Installation

- Prior to compost application, prepare the slope by removing loose rocks, roots, stumps, and other debris greater than 2" in diameter. Prepare the slope area surface by scarifying or track walking/roughening if necessary.
- Select method to apply the compost blanket. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.
- A compost blanket thickness of 1" to 4" should be applied to slopes of 2:1 (H:V) or gentler, based on site-specific conditions. Increase blanket thickness with increased slope steepness and/or during installation during the rainy season (for example, 2" to 3" should be used for a

3:1 slope, while 1" to 2" can be used for a 4:1 slope). Erosion control using a compost blanket is not recommended for slopes greater than 1:1 (H:V).

- For steeper slopes, tackifiers should be utilized and/or other stabilization techniques employed. For example, compost socks or berms can be installed at intervals over the compost blanket (in a similar manner as Fiber Rolls, SE-5).
- Compost socks or berms (or equivalent linear sediment control BMP) should be placed at the top and/or bottom of the slope for additional erosion control performance.
- For optimum vegetation establishment, a blanket thickness of 1" to 2" is recommended. If vegetation establishment is not the primary function of the compost blanket, a thicker blanket may be recommended based on slope or rainfall conditions.
- Evenly distribute compost on the soil surface to the desired blanket thickness (1/2" to 4" as calculated prior based on-site conditions and objectives). Even distribution is an important factor in preventing future rill and gully erosion.
- The compost blanket should extend 3 to 6 feet over the top of the shoulder of the slope. A compost sock or compost berm can be used at the top of the slope as an auxiliary technique to prevent runoff from flowing underneath the compost blanket.
- Use additional anchoring and erosion control BMPs in conjunction of the compost blanket as needed.

## Costs

The cost associated with a compost blanket is similar to that of a straw mat and generally less expensive than a geotextile blanket (USEPA, 2009). Caltrans has provided a recent estimate for \$5,600 to \$9,000 per acre for application of an unseeded 1-inch compost blanket (Caltrans Compost Specifications, 2009. Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.). Vendor costs indicate that proprietary blends of compost that are seeded and contain a nutrient rich "tackifier" can cost approximately \$0.45 per square foot, or approximately \$19,200 per acre for a 2-inch blanket (Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.). Application by hand is more time intensive and likely more costly.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident, another layer of compost should be reapplied as soon as possible. It may be necessary to install an additional type of stormwater BMP at the top of slope or as a slope interrupter to control flow, such as a fiber roll (SE-5) or compost sock (SE-11).
- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

- Limit or prohibit foot traffic to minimize damage to BMP or impede vegetation establishment.

## References

An Analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

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Standard Specifications for Transportation Materials and Methods of Sampling and Testing Designation M10-03, Compost for Erosion/Sediment Control (Compost Blankets), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

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## Description and Purpose

Soil Preparation/Roughening involves assessment and preparation of surface soils for BMP installation. This can include soil testing (for seed base, soil characteristics, or nutrients), as well as roughening surface soils by mechanical methods (including sheepsfoot rolling, track walking, scarifying, stair stepping, and imprinting) to prepare soil for additional BMPs, or to break up sheet flow. Soil Preparation can also involve tilling topsoil to prepare a seed bed and/or incorporation of soil amendments, to enhance vegetative establishment.

## Suitable Applications

**Soil preparation:** Soil preparation is essential to proper vegetative establishment. In particular, soil preparation (i.e. tilling, raking, and amendment) is suitable for use in combination with any soil stabilization method, including Rolled Erosion Control Products (RECPs) or sod. Soil preparation should not be confused with roughening.

**Roughening:** Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces. Soil preparation is most effective when used in combination with erosion controls. Soil Roughening is suitable for use as a complementary process for controlling erosion on a site. Roughening is not intended to be used as a stand-alone BMP, and should be used with perimeter controls, additional erosion control measures, grade breaks, and vegetative establishment for maximum effectiveness. Roughening is intended to only affect surface soils and should not compromise slope stability or overall compaction. Suitable applications for soil roughening include:

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
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## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-5 Soil Binders
- EC-7 Geotextiles and Mats

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- Along any disturbed slopes, including temporary stockpiles, sediment basins, or compacted soil diversion berms and swales.
- Roughening should be used in combination with hydraulically applied stabilization methods, compost blanket, or straw mulch; but should not be used in combination with RECPs or sod because roughening is intended to leave terraces on the slope.

## Limitations

- Preparation and roughening must take place prior to installing other erosion controls (such as hydraulically applied stabilizers) or sediment controls (such as fiber rolls) on the faces of slopes.
- In such cases where slope preparation is minimal, erosion control/revegetation BMPs that do not require extensive soil preparation - such as hydraulic mulching and seeding applications - should be employed.
- Consideration should be given to the type of erosion control BMP that follows surface preparation, as some BMPs are not designed to be installed over various types of tillage/roughening, i.e., RECPs should not be used with soil roughening due to a “bridging” effect, which suspends the blanket above the seed bed.
- Surface roughness has an effect on the amount of mulch material that needs to be applied, which shows up as a general increase in mulch material due to an increase in surface area (Topographic Index -see EC-3 Hydraulic Mulch).

## Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

## General

A roughened surface can significantly reduce erosion. Based on tests done at the San Diego State Erosion Research Laboratory, various roughening techniques on slopes can result in a 12 - 76% reduction in the erosion rate versus smooth slopes.

## Materials

Minimal materials are required unless amendments and/or seed are added to the soil. The majority of soil roughening/preparation can be done with equipment that is on hand at a normal construction site, such as bull dozers and compaction equipment.

## Installation Guidelines

### Soil Preparation

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.
- Based upon soil testing conducted, apply additional soil amendments (e.g., fertilizers, additional seed) to the soil to help with germination. Follow EC-4, Hydroseeding, when selecting and applying seed and fertilizers.

## **Cut Slope Roughening:**

- Stair-step grade or groove the cut slopes that are steeper than 3:1.
- Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
- Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.
- Do not make individual vertical cuts more than 2 ft. (0.6 m) high in soft materials or more than 3 ft. (0.9 m) high in rocky materials.
- Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

## **Fill Slope Roughening:**

- Place on fill slopes with a gradient steeper than 3:1 in lifts not to exceed 8 in. (0.2 m), and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4-6 in. (0.1-0.2 m) deep.
- Use grooving or tracking to roughen the face of the slopes, if necessary.
- Do not blade or scrape the final slope face.

## **Roughening for Slopes to be Mowed:**

- Slopes that require mowing activities should not be steeper than 3:1.
- Roughen these areas to shallow grooves by track walking, scarifying, sheepsfoot rolling, or imprinting.
- Make grooves close together (less than 10 in.), and not less than 1 in. deep, and perpendicular to the direction of runoff (i.e., parallel to the slope contours).
- Excessive roughness is undesirable where mowing is planned.

## **Roughening with Tracked Machinery:**

- Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface.
- Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
- Seed and mulch roughened areas as soon as possible to obtain optimum seed germination and growth.

## **Costs**

Costs are based on the additional labor of tracking or preparation of the slope plus the cost of any required soil amendment materials.

## **Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check the seeded slopes for signs of erosion such as rills and gullies. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
- Inspect BMPs weekly during normal operations, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

## **References**

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.





## Description and Purpose

Non-vegetative stabilization methods are used for temporary or permanent stabilization of areas prone to erosion and should be used only where vegetative options are not feasible; examples include:

- Areas of vehicular or pedestrian traffic such as roads or paths;
- Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
- Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
- Areas where vegetation will not grow adequately within the construction time frame.

There are several non-vegetative stabilization methods and selection should be based on site-specific conditions.

**Decomposed Granite (DG)** is a permanent erosion protection method that consists of a layer of stabilized decomposed granite placed over an erodible surface.

**Degradable Mulches** of various types (see EC-3, EC-6, EC-8) can be used for temporary non-vegetative stabilization; examples include straw mulch, compost, wood chips or hydraulic mulch.

**Geotextiles and Mats** can be used for temporary non-vegetative stabilization (see EC-7). These BMPs are typically manufactured from degradable or synthetic materials and are

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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designed and specified based on their functional longevity, i.e., how long they will persist and provide erosion protection. All geotextiles and mats should be replaced when they exceed their functional longevity or when permanent stabilization methods are instituted.

**Gravel Mulch** is a non-degradable erosion control product that is composed of washed and screened coarse to very coarse gravel, 16 mm to 64 mm (0.6" - 2.5"), similar to an AASHTO No. 3 coarse aggregate.

**Rock Slope Protection** consists of utilizing large rock or rip-rap (4" - 24") to stabilize slopes with a high erosion potential and those subject to scour along waterways.

**Soil Binders** can be used for temporary non-vegetative stabilization (see EC-5). The key to their use is functional longevity. In most cases, the soil binder will need to be routinely monitored and re-applied to maintain an erosion-resistant coverage.

## Suitable Applications

Non-vegetated stabilization methods are suitable for use on disturbed soil areas and on material stockpiles that need to be temporarily or permanently protected from erosion by water and wind. Non-vegetated stabilization should only be utilized when vegetation cannot be established in the required timeframe, due to soil or climactic conditions, or where vegetation may be a potential fire hazard.

**Decomposed Granite (DG) and Gravel Mulch** are suitable for use in areas where vegetation establishment is difficult, on flat surfaces, trails and pathways, and when used in conjunction with a stabilizer or tackifier, on shallow slopes (i.e., 10:1 [H:V]). DG and gravel can also be used on shallow rocky slopes where vegetation cannot be established for permanent erosion control.

**Degradable Mulches** can be used to cover and protect soil surfaces from erosion both in temporary and permanent applications. In many cases, the use of mulches by themselves requires routine inspection and re-application. See EC-3 Hydraulic Mulch, EC-6 Straw Mulch, EC-8 Wood Mulch, or EC-14 Compost Blankets for more information.

**Geotextiles and Mats** can be used as a temporary stand-alone soil stabilization method. Depending on material selection, geotextiles and mats can be a short-term (3 mos – 1 year) or long-term (1-2 years) temporary stabilization method. For more information on geotextiles and mats see EC-7 Geotextiles and Mats.

**Rock Slope Protection** can be used when the slopes are subject to scour or have a high erosion potential, such as slopes adjacent to flowing waterways or slopes subject to overflow from detention facilities (spillways).

**Soil Binders** can be used for temporary stabilization of stockpiles and disturbed areas not subject to heavy traffic. See EC-5 Soil Binders for more information.

## Limitations

### General

- Refer to EC-3, EC-6, EC-8, and EC-14 for limitations on use of mulches. Refer to EC-7 for limitations on use of geotextiles and mats. Refer to EC-5 for limitations on use of Soil Binders.

## ***Decomposed Granite***

- Not available in some geographic regions.
- If not tackified, material may be susceptible to erosion even on slight slopes (e.g., 30:1 [H:V]).
- Installed costs may be more expensive than vegetative stabilization methods.

## ***Gravel Mulch***

- Availability is limited in some geographic regions.
- If not properly screened and washed, can contain fine material that can erode and/or create dust problems.
- If inadequately sized, material may be susceptible to erosion on sloped areas.
- Pore spaces fill with dirt and debris over time; may provide a growing medium for weeds.

## ***Rock Slope Protection***

- Installation is labor intensive.
- Installed costs can be significantly higher than vegetative stabilization methods.
- Rounded stones may not be used on slopes greater than 2:1 [H:V].

## **Implementation**

### ***General***

Non-vegetated stabilization should be used in accordance with the following general guidance:

- Should be used in conjunction with other BMPs, including drainage, erosion controls and sediment controls.
- Refer to EC-3, EC-6, EC-8, and EC-14 for implementation details for mulches. Refer to EC-7 for implementation details for geotextiles and mats. Refer to EC-5 for implementation details for soil binders.
- Non-vegetated stabilization measures should be implemented as soon as the disturbance in the areas they are intended to protect has ceased.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

### ***Decomposed Granite Stabilization***

- If used for a road or path should be installed on a prepared base.
- Should be mixed with a stabilizer if used for roads or pathways, or on slope applications.
- Though porous it is recommended to prevent standing water on or next to a decomposed granite road or pathway.

## ***Gravel Mulch***

- Should be sized based on slope, rainfall, and upgradient run-on conditions. Stone size should be increased as potential for erosion increases (steeper slopes, high intensity rainfall).
- If permanent, a weed control fabric should be placed prior to installation.
- Should be installed at a minimum 2" depth.
- Should completely cover all exposed surfaces.

## ***Rock Slope Protection***

- Rock slope protection installation should follow Caltrans Standard Specification 72-2: Rock Slope Protection. Refer to the specification for rock conformity requirements and installation methods.
- When using rock slope protection, rock size and installation method should be specified by an Engineer.
- A geotextile fabric should be placed prior to installation.

## **Costs**

- Costs are highly variable depending not only on technique chosen, but also on materials chosen within specific techniques. In addition, availability of certain materials will vary by region/location, which will also affect the cost. Costs of mulches, geotextiles and mats, and soil binders are presented in their respective fact sheets. Costs for decomposed granite, gravel mulch stabilization and rock slope protection may be higher depending on location and availability of materials. Caltrans has provided an estimate for gravel mulch of \$13 - \$20/yd<sup>2</sup> in flat areas and \$14 - \$30/yd<sup>2</sup> on side slopes (adjusted for inflation, 2016 dollars).

## **Inspection and Maintenance**

### ***General***

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- For permanent installation, require inspection periodically and after major storm events to look for signs of erosion or damage to the stabilization.
- All damage should be repaired immediately.
- Refer to EC-3, EC-6, EC-8, and EC-14 for inspection and maintenance requirements for mulches. Refer to EC-7 for inspection and maintenance requirements for geotextiles and mats. Refer to EC-5 for inspection and maintenance requirements for soil binders.

## ***Decomposed Granite and Gravel Mulch Stabilization***

- Rake out and add decomposed granite or gravel as needed to areas subject to rill erosion. Inspect upgradient drainage controls and repair/modify as necessary.

- Should remain stable under loose surface material. Any significant problem areas should be repaired to restore uniformity to the installation.

## References

Arid Zone Forestry: A Guide for Field Technicians. Food and Agriculture Organization of the United Nations, 1989.

Design of Roadside Channels with Flexible Linings, Hydraulic Engineering Circular Number 15, Third Edition, Federal Highway Administration, 2007.

Design Standards for Urban Infrastructure - Soft Landscape Design, Department of Territory and Municipal Services - Australian Capital Territory [http://www.tams.act.gov.au/work/standards\\_and\\_procedures/design\\_standards\\_for\\_urban\\_infrastructure](http://www.tams.act.gov.au/work/standards_and_procedures/design_standards_for_urban_infrastructure)

Erosion and Sediment Control Handbook: A Guide for Protection of State Waters through the use of Best Management Practices during Land Disturbing Activities, Tennessee Department of Environment and Conservation, 2002.

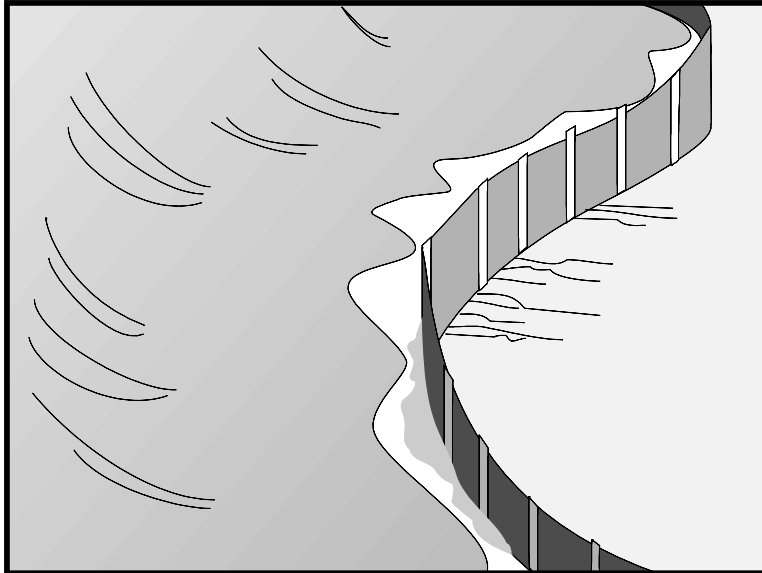
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Maine Erosion and Sediment Control BMPs, DEPLW0588, Maine Department of Environmental Protection: Bureau of Land and Water Quality, 2003.

National Menu of Best Management Practices, US Environmental Protection Agency, 2006.

Standard Specification 72-2: Rock Slope Protection. California Department of Transportation, 2006.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.



## Description and Purpose

A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains water, promoting sedimentation of coarse sediment behind the fence. Silt fence does not retain soil fine particles like clays or silts.

## Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (Storm Drain Inlet Protection, SE-10). Silt fences should not be used in locations where the flow is concentrated. Silt fences should always be used in combination with erosion controls. Suitable applications include:

- At perimeter of a project (although they should not be installed up and down slopes).
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- Below other small cleared areas.

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment (coarse sediment)	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm SE-12
- Manufactured Linear Sediment Controls
- SE-13 Compost Socks and Berms
- SE-14 Biofilter Bags

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## Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.
- Do not use in locations where ponded water may cause a flooding hazard.
- Do not use silt fence to divert water flows or place across any contour line.
- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.
- Must be trenched and keyed in.
- According to the State Water Board's *CGP Review, Issue #2* (2014), silt fences reinforced with metal or plastic mesh should be avoided due to plastic pollution and wildlife concerns.
- Not intended for use as a substitute for Fiber Rolls (SE-5), when fiber rolls are being used as a slope interruption device.
- Do not use on slopes subject to creeping, slumping, or landslides.

## Implementation

### General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap coarse sediment by intercepting and detaining sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Silt fence should be used in combination with erosion controls up-slope in order to provide the most effective sediment control.
- Silt fence alone is not effective at reducing turbidity. (Barrett and Malina, 2004)
- Designers should consider diverting sediment laden water to a temporary sediment basin or trap. (EPA, 2012)
- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 ft. at any point along the silt fence.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft.<sup>2</sup> of ponding area should be provided for every acre draining to the fence.
- Efficiency of silt fences is primarily dependent on the detention time of the runoff behind the control. (Barrett and Malina, 2004)

- The drainage area above any fence should not exceed a quarter of an acre. (Rule of Thumb-100-feet of silt fence per 10,000 ft.<sup>2</sup> of disturbed area.) (EPA, 2012)
- The maximum length of slope draining to any point along the silt fence should be 100 ft. per ft of silt fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area draining to the silt fence is permanently stabilized, after which, the silt fence fabric and posts should be removed and properly disposed.
- J-hooks, which have ends turning up the slope to break up long runs of fence and provide multiple storage areas that work like mini-retention areas, may be used to increase the effectiveness of silt fence.
- Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

## ***Design and Layout***

In areas where high winds are anticipated the fence should be supported by a plastic or wire mesh. The geotextile fabric of the silt fence should contain ultraviolet inhibitors and stabilizers to provide longevity equivalent to the project life or replacement schedule.

- Layout in accordance with the attached figures.
- For slopes that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to protect silt fence from rocks (e.g., rockfall netting) ensure the integrity of the silt fence installation.

## ***Standard vs. Heavy Duty Silt Fence***

### ***Standard Silt Fence***

- Generally applicable in cases where the area draining to fence produces moderate sediment loads.

### ***Heavy Duty Silt Fence***

- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
- Use is generally limited to areas affected by high winds.
- Area draining to fence produces moderate sediment loads.

## ***Materials***

### ***Standard Silt Fence***

- Silt fence material should be woven geotextile with a minimum width of 36 in. The fabric should conform to the requirements in ASTM designation D6461.

- Wooden stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.
- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15-gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

### *Heavy-Duty Silt Fence*

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts instead of wood stakes.

### **Installation Guidelines – Traditional Method**

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).
- Bottom of the silt fence should be keyed-in a minimum of 12 in.
- Posts should be spaced a maximum of 6 ft. apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.
- When standard strength geotextile is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy-duty wire staples at least 1 in. long. The mesh should extend into the trench.
- When extra-strength geotextile and closer post spacing are used, the mesh support fence may be eliminated.
- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.
- The trench should be backfilled with native material and compacted.
- Construct the length of each reach so that the change in base elevation along the reach does not exceed  $\frac{1}{3}$  the height of the barrier; in no case should the reach exceed 500 ft.
- Cross barriers should be a minimum of  $\frac{1}{3}$  and a maximum of  $\frac{1}{2}$  the height of the linear barrier.
- See typical installation details at the end of this fact sheet.



## ***Installation Guidelines - Static Slicing Method***

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 in. into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the geotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
  - Ease of installation (most often done with a 2-person crew).
  - Minimal soil disturbance.
  - Better level of compaction along fence, less susceptible to undercutting
  - Uniform installation.
- Limitations:
  - Does not work in shallow or rocky soils.
  - Complete removal of geotextile material after use is difficult.
  - Be cautious when digging near potential underground utilities.

## **Costs**

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is \$7 per linear foot based on vendor research. Range of cost is \$3.50 - \$9.10 per linear foot.

## **Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches 1/3 of the barrier height.

- Silt fences should be left in place until the upgradient area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.
- Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

## References

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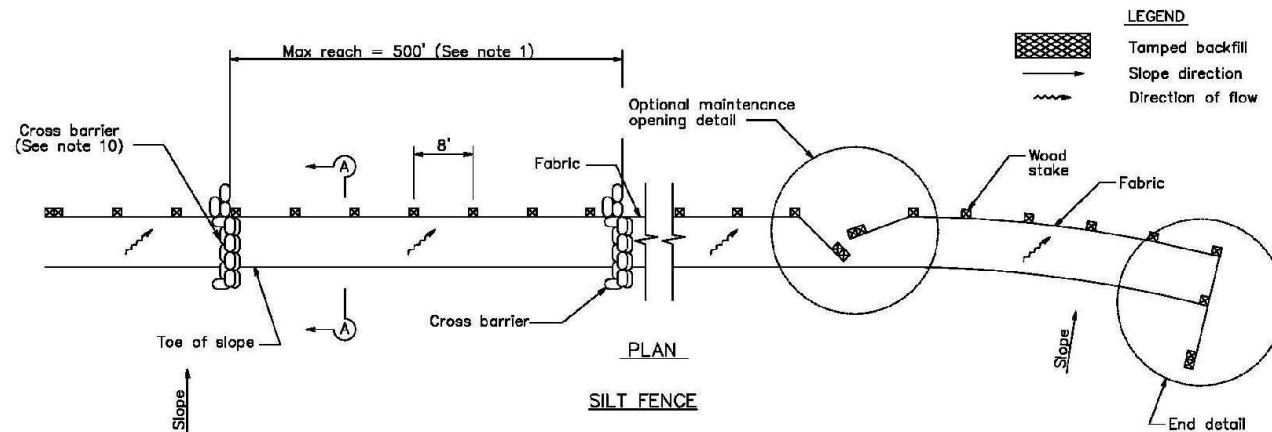
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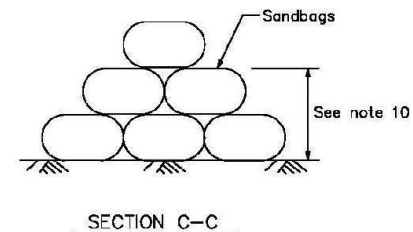
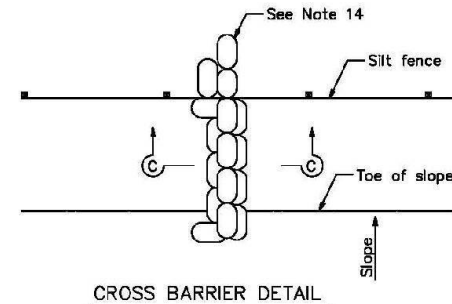
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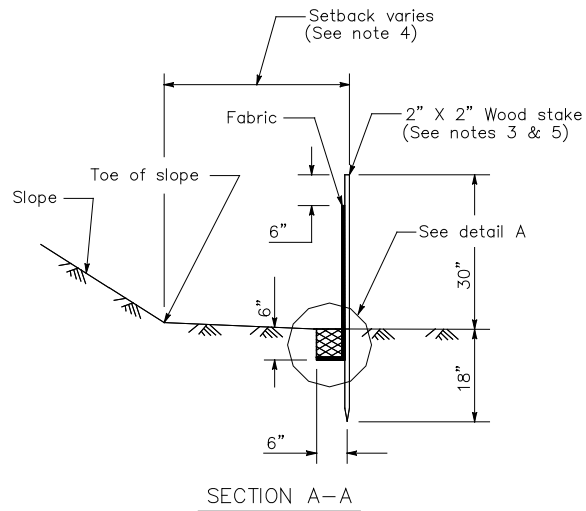
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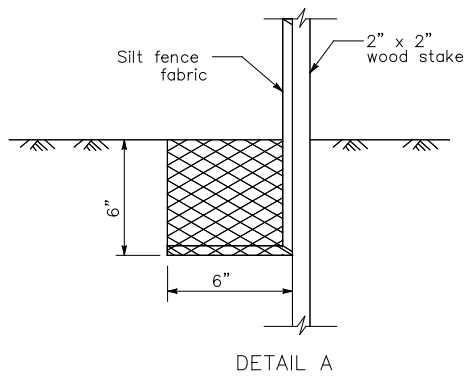
## NOTES

- Construct the length of each reach so that the change in base elevation along the reach does not exceed  $1/3$  the height of the linear barrier. In no case shall the reach length exceed 500'.
- The last 8'-0" of fence shall be turned up slope.
- Stake dimensions are nominal.
- Dimension may vary to fit field condition.
- Stakes shall be spaced at 8'-0" maximum and shall be positioned on downstream side of fence.
- Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
- Stakes shall be driven tightly together to prevent potential flow-through of sediment at joint. The tops of the stakes shall be secured with wire.
- For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
- Minimum 4 staples per stake. Dimensions shown are typical.
- Cross barriers shall be a minimum of  $1/3$  and a maximum of  $1/2$  the height of the linear barrier.
- Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
- Joining sections shall not be placed at sump locations.
- Sandbag rows and layers shall be offset to eliminate gaps.
- Add 3-4 bags to cross barrier on downgradient side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbance.

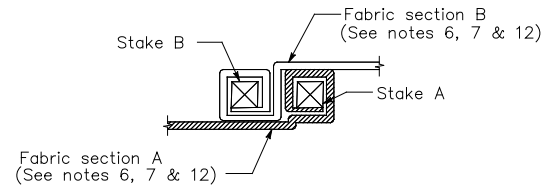




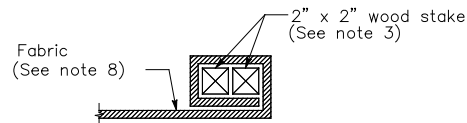
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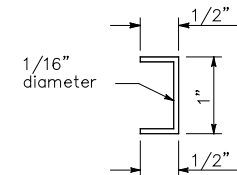
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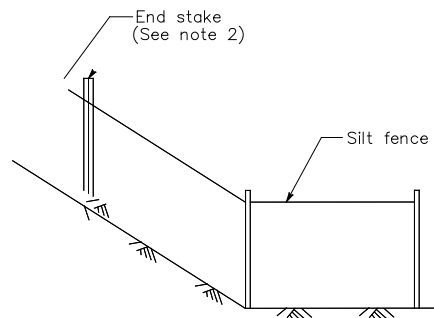
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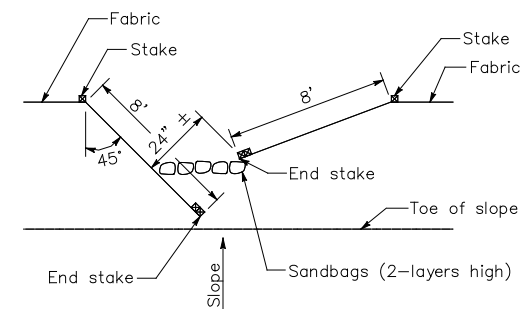
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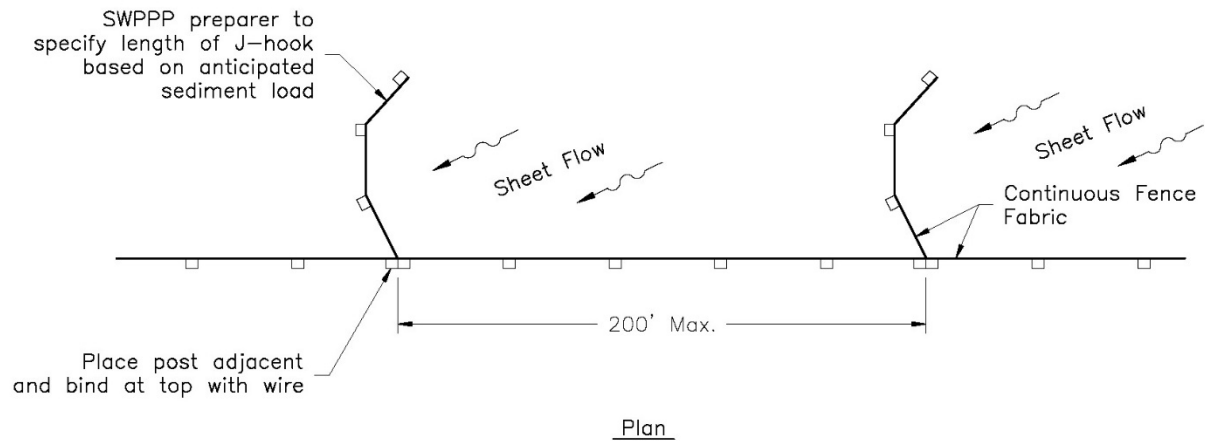
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(SEE NOTE 9)



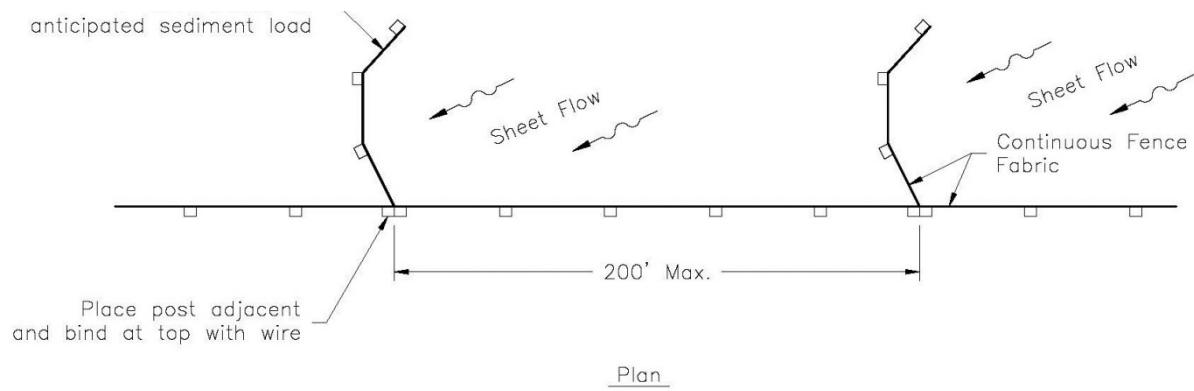
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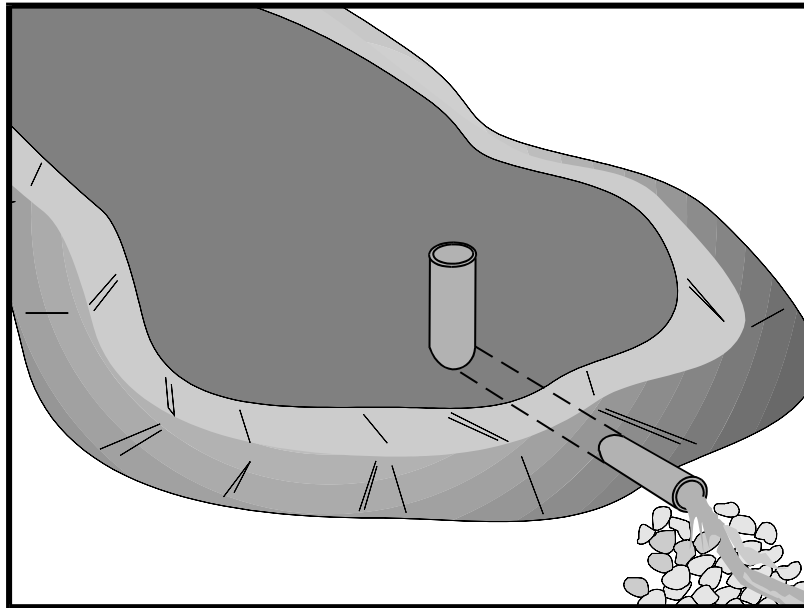
OPTIONAL MAINTENANCE OPENING DETAIL  
(SEE NOTE 11)



## J-HOOK



## J-HOOK



## Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is released.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin
- Erosion control practices to minimize disturbed areas on-site and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Category
- ☒ Secondary Category

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

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(a.k.a. “physical”) enhancements such as alternative outlet configurations or flow deflection baffles increase detention time and other techniques such as outlet skimmers preferentially drain flows with lower sediment concentrations. These “physical” enhancement techniques are described in this fact sheet. To further enhance sediment removal particularly at sites with fine soils or turbidity sensitive receiving waters, some projects may need to consider implementing Active Treatment Systems (ATS) whereby coagulants and flocculants are used to enhance settling and removal of suspended sediments. Guidance on implementing ATS is provided in SE-11.

## Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres and evaluated on a site by site basis
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

## Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- As a general guideline, sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. However, the tributary area should be evaluated on a site by site basis.
- Sediment basins may become an “attractive nuisance” and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this fact sheet are only effective in removing sediment down to about the silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical (or other appropriate method) treatment is used in addition to the sediment basin.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from California Department of Water Resources Division of Safety of Dams (<http://www.water.ca.gov/damsafety/>).



- Water that stands in sediment basins longer than 96 hours may become a source of mosquitoes (and midges), particularly along perimeter edges, in shallow zones, in scour or below-grade pools, around inlet pipes, along low-flow channels, and among protected habitats created by emergent or floating vegetation (e.g. cattails, water hyacinth), algal mats, riprap, etc.
- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

## Implementation

### *General*

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure expected to be used during active construction in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to convey runoff to the basin inlet.

Many development projects in California are required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins if properly designed and maintained can trap a significant amount of the sediment that flows into them. However, traditional basins do not remove all inflowing sediment. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

### *Planning*

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. Locations best suited for a sediment basin are generally in lower elevation areas of the site (or basin tributary area) where site drainage would not require significant diversion or other means to direct water to the basin but outside jurisdictional waterways. However, as necessary, drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Construct before clearing and grading work begins when feasible.

- Do not locate the basin in a jurisdictional stream.

- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft must obtain approval from the Division of Dam Safety. Local dam safety requirements may be more stringent.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

## **Design**

When designing a sediment basin, designers should evaluate the site constraints that could affect the efficiency of the BMP. Some of these constraints include: the relationship between basin capacity, anticipated sediment load, and freeboard, available footprint for the basin, maintenance frequency and access, and hydraulic capacity and efficiency of the temporary outlet infrastructure. Sediment basins should be designed to maximize sediment removal and to consider sediment load retained by the basin as it affects basin performance.

Three Basin Design Options (Part A) are presented below along with a Typical Sediment/Detention Basin Design Methodology (Part B). Regardless of the design option that is selected, designers also need to evaluate the sediment basin capacity with respect to sediment accumulation (See “*Step 3. Evaluate the Capacity of the Sediment Basin*”) and should incorporate approaches identified in “*Step 4. Other Design Considerations*” to enhance basin performance.

### **A) Basin Design Options:**

#### **Option 1:**

Design sediment basin(s) using the standard equation:

$$A_s = \frac{1.2Q}{V_s} \quad (\text{Eq. 1})$$

Where:

$A_s$  = Minimum surface area for trapping soil particles of a certain size

$V_s$  = Settling velocity of the design particle size chosen ( $V_s = 0.00028$  ft/s for a design particle size of 0.01 mm at 68°F)

1.2 = Factor of safety recommended by USEPA to account for the reduction in basin efficiency caused due to turbulence and other non ideal conditions.

$$Q = CIA \quad (\text{Eq.2})$$

Where

Q = Peak basin influent flow rate measured in cubic feet per second (ft<sup>3</sup>/s)

C = Runoff coefficient (unitless)

I = Peak rainfall intensity for the 10-year, 6-hour rain event (in/hr)

A = Area draining into the sediment basin in acres

The design particle size should be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the Vs used should be 100 percent of the calculated settling velocity.

This sizing basin method is dependent on the outlet structure design or the total basin length with an appropriate outlet. If the designer chooses to utilize the outlet structure to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a minimum of twice the basin width; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). If the designer chooses to utilize the basin length (with appropriate basin outlet) to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a specifically designed to capture 100% of the design particle size; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity).

Basin design guidance provided herein assumes standard water properties (e.g., estimated average water temperature, kinematic viscosity, etc.) as a basis of the design. Designers can use an alternative design (Option 3) with site specific water properties as long as the design is as protective as Option 1.

The design guidance uses the peak influent flow rate to size sediment basins. Designers can use an alternative design (Option 3) with site specific average flow rates as long as the design is as protective as Option 1.

The basin should be located on the site where it can be maintained on a year-round basis and should be maintained on a schedule to retain the 2 ft of capacity.

## **Option 2:**

Design pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 1.

## **Option 3:**

The use of an equivalent surface area design or equation provided that the design efficiency is as protective or more protective of water quality than Option 1.

## ***B) Typical Sediment/Detention Basin Design Methodology:***

Design of a sediment basin requires the designer to have an understanding of the site constraints, knowledge of the local soil (e.g., particle size distribution of potentially contributing soils), drainage area of the basin, and local hydrology. Designers should not assume that a sediment basin for location A is applicable to location B. Therefore, designers can use this factsheet as guidance but will need to apply professional judgment and knowledge of the site to design an effective and efficient sediment basin. The following provides a general overview of typical design methodologies:

### *Step 1. Hydrologic Design*

- Evaluate the site constraints and assess the drainage area for the sediment basin. Designers should consider on- and off-site flows as well as changes in the drainage area associated with site construction/disturbance. To minimize additional construction during the course of the project, the designer should consider identifying the maximum drainage area when calculating the basin dimensions.
- If a local hydrology manual is not available, it is recommended to follow standard rational method procedures to estimate the flow rate. The references section of this factsheet provides a reference to standard hydrology textbooks that can provide standard methodologies. If local rainfall depths are not available, values can be obtained from standard precipitation frequency maps from NOAA (downloaded from <http://www.wrcc.dri.edu/pcpnfreq.html>).

### *Step 2. Hydraulic Design*

- Calculate the surface area required for the sediment basin using Equation 1. In which the flow rate is estimated for a 10-yr 6-hr event using rational method procedure listed in local hydrology manual and  $V_s$  is estimated using Stokes Law presented in Equation 3.

$$V_s = 2.81d^2 \quad (\text{Eq.3})$$

Where

$V_s$  = Settling velocity in feet per second at 68°F

$d$  = diameter of sediment particle in millimeters (smallest soil grain size determined by wet sieve analysis or fine silt [0.01 mm [or 0.0004 in.]])

- In general, the basin outlet design requires an iterative trial and error approach that considered the maximum water surface elevation, the elevation versus volume (stage-storage) relationship, the elevation versus basin outflow (a.k.a.-discharge) relationship, and the estimated inflow hydrograph. To adequately design the basins to settle sediment, the outlet configuration and associated outflow rates can be estimated by numerous methodologies. The following provides some guidance for design the basin outlet:
  - An outlet should have more than one orifice.
  - An outlet design typically utilizes multiple horizontal rows of orifices (approximately 3 or more) with at least 2 orifices per row (see Figures 1 and 2 at the end of this fact sheet).

- Orifices can vary in shape.
- Select the appropriate orifice diameter and number of perforations per row with the objective of minimizing the number of rows while maximizing the detention time.
- The diameter of each orifice is typically a maximum of 3-4 inches and a minimum of 0.25-0.5 inches.
- If a rectangular orifice is used, it is recommended to have minimum height of 0.5 inches and a maximum height of 6 inches.
- Rows are typically spaced at three times the diameter center to center vertically with a minimum distance of approximately 4 inches on center and a maximum distance of 1 foot on center.
- To estimate the outflow rate, each row is calculated separately based on the flow through a single orifice then multiplied by the number of orifices in the row. This step is repeated for each of the rows. Once all of the orifices are estimated, the total outflow rate versus elevation (stage-discharge curve) is developed to evaluate the detention time within the basin.
- Flow through a single orifice can be estimated using an Equation 4:

$$Q = BC' A(2gH)^{0.5} \quad (\text{Eq.4})$$

Where

Q = Outflow rate in ft<sup>3</sup>/s

C' = Orifice coefficient (unitless)

A = Area of the orifice (ft<sup>2</sup>)

g = acceleration due to gravity (ft<sup>3</sup>/s)

H = Head above the orifice (ft)

B = Anticipated Blockage or clogging factor (unitless), It is dependent on anticipated sediment and debris load, trash rack configuration etc, so the value is dependent on design engineer's professional judgment and/or local requirements (B is never greater than 1 and a value of 0.5 is generally used)

- Care must be taken in the selection of orifice coefficient ("C'"); 0.60 is most often recommended and used. However, based on actual tests, Young and Graziano (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:
  - C' = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or
  - C' = 0.80 when the material is thicker than the orifice diameter
- If different sizes of orifices are used along the riser then they have to be sized such that not more than 50 percent of the design storm event drains in one-third of the drawdown time (to provide adequate settling time for events smaller than the design storm event)

and the entire volume drains within 96 hours or as regulated by the local vector control agency. If a basin fails to drain within 96 hours, the basin must be pumped dry.

- Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.
- Floating Outlet Skimmer: The floating skimmer (see Figure 3 at the end of this fact sheet is an alternative outlet configuration (patented) that drains water from upper portion of the water column. This configuration has been used for temporary and permanent basins and can improve basin performance by eliminating bottom orifices which have the potential of discharging solids. Some design considerations for this alternative outlet device includes the addition of a sand filter or perforated under drain at the low point in the basin and near the floating skimmer. These secondary drains allow the basin to fully drain. More detailed guidelines for sizing the skimmer can be downloaded from <http://www.fairclothskimmer.com/>.
- Hold and Release Valve: An ideal sediment/detention basin would hold all flows to the design storm level for sufficient time to settle solids, and then slowly release the storm water. Implementing a reliable valve system for releasing detention basins is critical to eliminate the potential for flooding in such a system. Some variations of hold and release valves include manual valves, bladder devices or electrically operated valves. When a precipitation event is forecast, the valve would be close for the duration of the storm and appropriate settling time. When the settling duration is met (approximately 24 or 48 hours), the valve would be opened and allow the stormwater to be released at a rate that does not resuspend settled solids and in a non-erosive manner. If this type of system is used the valve should be designed to empty the entire basin within 96 hours or as stipulated by local vector control regulations.

### *Step 3. Evaluate the Capacity of the Sediment Basin*

- Typically, sediment basins do not perform as designed when they are not properly maintained or the sediment yield to the basin is larger than expected. As part of a good sediment basin design, designers should consider maintenance cycles, estimated soil loss and/or sediment yield, and basin sediment storage volume. The two equations below can be used to quantify the amount of soil entering the basin.
- The Revised Universal Soil Loss Equation (RUSLE, Eq.5) can be used to estimate annual soil loss and the Modified Universal Soil Equation (MUSLE, Eq.6) can be used to estimate sediment yield from a single storm event.

$$A = R \times K \times LS \times C \times P \quad (\text{Eq.5})$$

$$Y = 95(Q \times q_p)^{0.56} \times K \times LS \times C \times P \quad (\text{Eq.6})$$

Where:

A = annual soil loss, tons/acre-year

R = rainfall erosion index, in 100 ft. Tons/acre.in/hr.

K = soil erodibility factor, tons/acre per unit of R

LS = slope length and steepness factor (unitless)

C = vegetative cover factor (unitless)

P = erosion control practice factor (unitless)

Y = single storm sediment yield in tons

Q = runoff volume in acre-feet

$q_p$  = peak flow in cfs

- Detailed descriptions and methodologies for estimating the soil loss can be obtained from standard hydrology text books (See References section).
- Determination of the appropriate equation should consider construction duration and local environmental factors (soils, hydrology, etc.). For example, if a basin is planned for a project duration of 1 year and the designer specifies one maintenance cycle, RUSLE could be used to estimate the soil loss and thereby the designer could indicate that the sediment storage volume would be half of the soil loss value estimated. As an example, for use of MUSLE, a project may have a short construction duration thereby requiring fewer maintenance cycles and a reduced sediment storage volume. MUSLE would be used to estimate the anticipated soil loss based on a specific storm event to evaluate the sediment storage volume and appropriate maintenance frequency.
- The soil loss estimates are an essential step in the design, and it is essential that the designer provide construction contractors with enough information to understand maintenance frequency and/or depths within the basin that would trigger maintenance. Providing maintenance methods, frequency and specification should be included in design bid documents such as the SWPPP Site Map.
- Once the designer has quantified the amount of soil entering the basin, the depth required for sediment storage can be determined by dividing the estimated sediment loss by the surface area of the basin.

## *Step 4. Other Design Considerations*

- Consider designing the volume of the settling zone for the total storm volume associated with the 2-year event or other appropriate design storms specified by the local agency. This volume can be used as a guide for sizing the basin without iterative routing calculations. The depth of the settling zone can be estimated by dividing the estimated 2-yr storm volume by the surface area of the basin.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.

- The basin depth must be no less than 3 ft (not including freeboard).
- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 96 hours (also referred to as “drawdown time”). The 24-hour limit is specified to provide adequate settling time; the 96-hour limit is specified to mitigate vector control concerns.
- Confirmation of the basin performance can be evaluated by routing the design storm (10-yr 6-hr, or as directed by local regulations) through the basin based on the basin volume (stage-storage curve) and the outlet design (stage-discharge curve based on the orifice configuration or equivalent outlet design).
- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.
  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap (or equivalent protection) on fill slopes.
  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.
- Rock, vegetation or appropriate erosion control should be used to protect the basin inlet, outlet, and slopes against erosion.
- The total depth of the sediment basin should include the depth required for sediment storage, depth required for settling zone and freeboard of at least 1 foot or as regulated by local flood control agency for a flood event specified by the local agency.
- The basin alignment should be designed such that the length of the basin is more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet. If the site topography does not allow for this configuration baffles should be installed so that the ratio is satisfied. If a basin has more than one inflow point, any inflow point that conveys more than 30 percent of the total peak inflow rate has to meet the required length to width ratio.
- An alternative basin sizing method proposed by Fifield (2004) can be consulted to estimate an alternative length to width ratio and basin configuration. These methods can be considered as part of Option 3 which allows for alternative designs that are protective or more protective of water quality.
- Baffles (see Figure 4 at the end of this fact sheet) can be considered at project sites where the existing topography or site constraints limit the length to width ratio. Baffles should be constructed of earthen berms or other structural material within the basin to divert flow in the basin, thus increasing the effective flow length from the basin inlet to the outlet riser. Baffles also reduce the change of short circuiting and allows for settling throughout the basin.



- Baffles are typically constructed from the invert of the basin to the crest of the emergency spillway (i.e., design event flows are meant to flow around the baffles and flows greater than the design event would flow over the baffles to the emergency spillway).
- Use of other materials for construction of basin baffles (such as silt fence) may not be appropriate based on the material specifications and will require frequent maintenance (maintain after every storm event). Maintenance may not be feasible when required due to flooded conditions resulting from frequent (i.e., back to back) storm events. Use of alternative baffle materials should not deviate from the intended purpose of the material, as described by the manufacturer.
- Sediment basins are best used in conjunction with erosion controls.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 ft<sup>3</sup>, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- A forebay, constructed upstream of the basin, may be provided to remove debris and larger particles.
- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.

## ***Installation***

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.

- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

## Costs

The cost of a sediment basin is highly variable and is dependent of the site configuration. To decrease basin construction costs, designers should consider using existing site features such as berms or depressed area to site the sediment basin. Designers should also consider potential savings associated with designing the basin to minimize the number of maintenance cycles and siting the basin in a location where a permanent BMP (e.g., extended detention basin) is required for the project site.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level and as required by local requirements. It is recommended that at a minimum, basins be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the basin must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance should be managed properly. The sediment should be appropriately evaluated and used or disposed of accordingly. Options include: incorporating sediment into earthwork on the site (only if there is no risk that sediment is contaminated); or off-site export/disposal at an appropriate location (e.g., sediment characterization and disposal to an appropriate landfill).
- Remove standing water from basin within 96 hours after accumulation.
- If the basin does not drain adequately (e.g., due to storms that are more frequent or larger than the design storm or other unforeseen site conditions), dewatering should be conducted in accordance with appropriate dewatering BMPs (see NS-2) and in accordance with local permits as applicable.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

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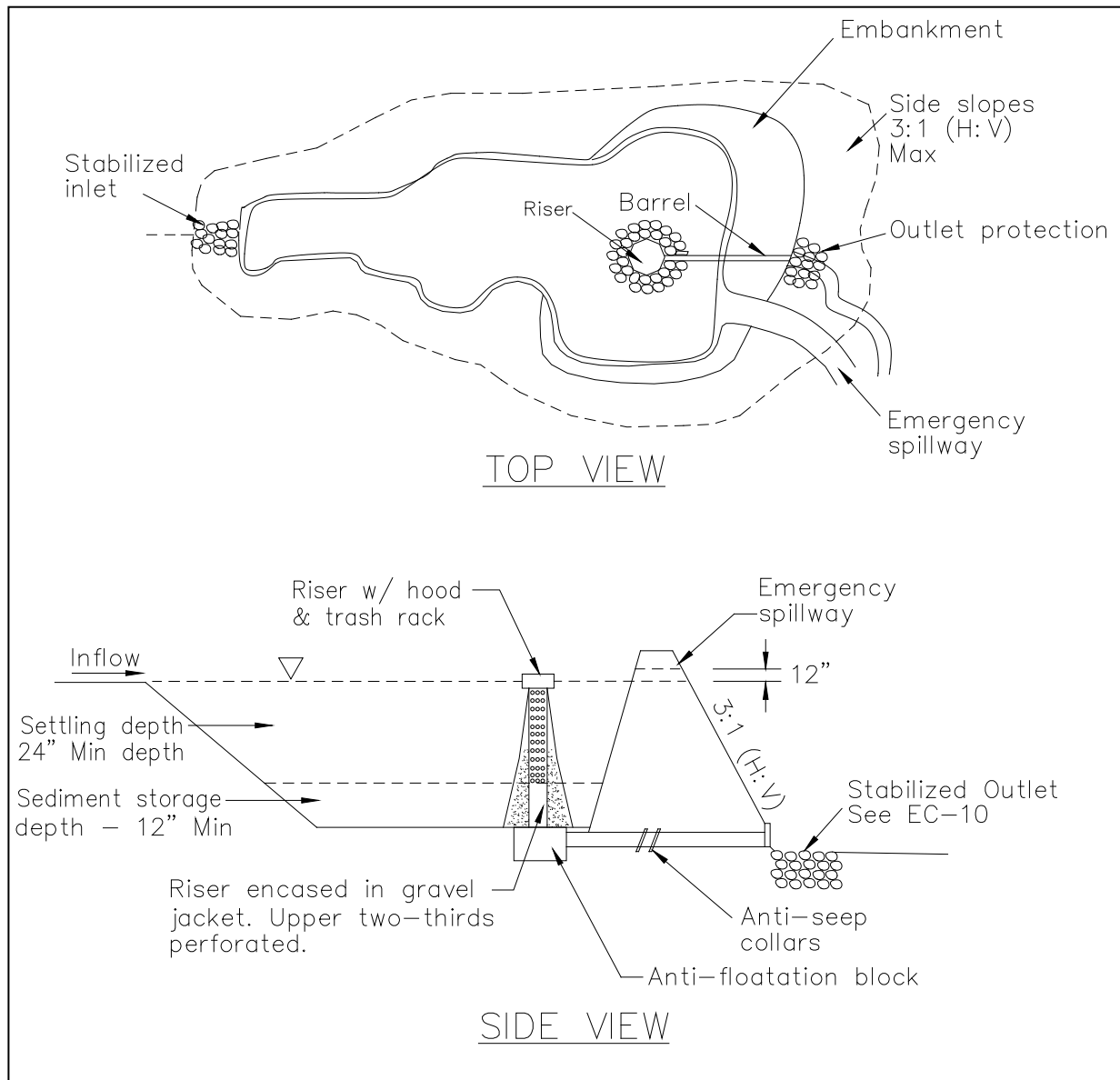
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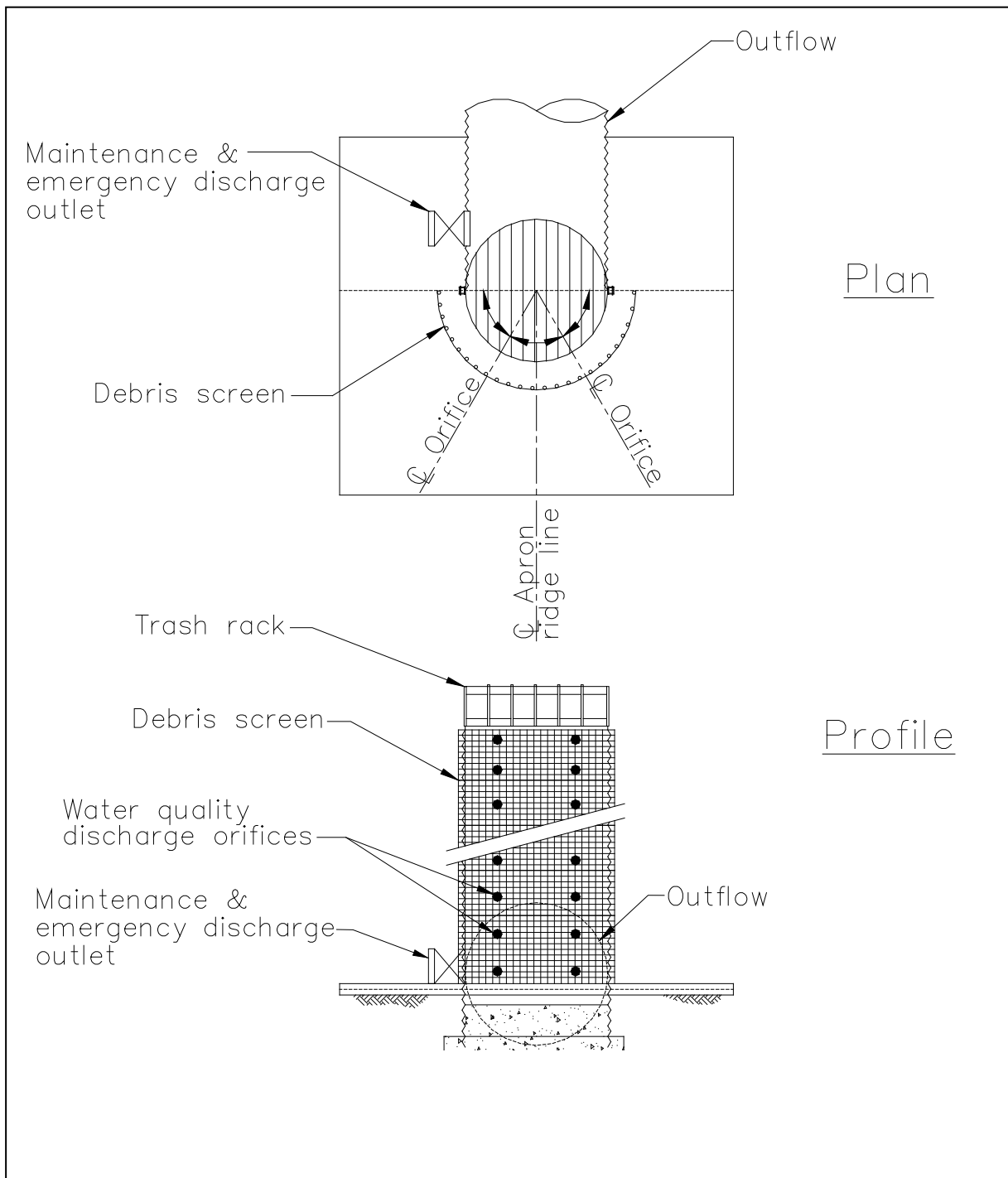
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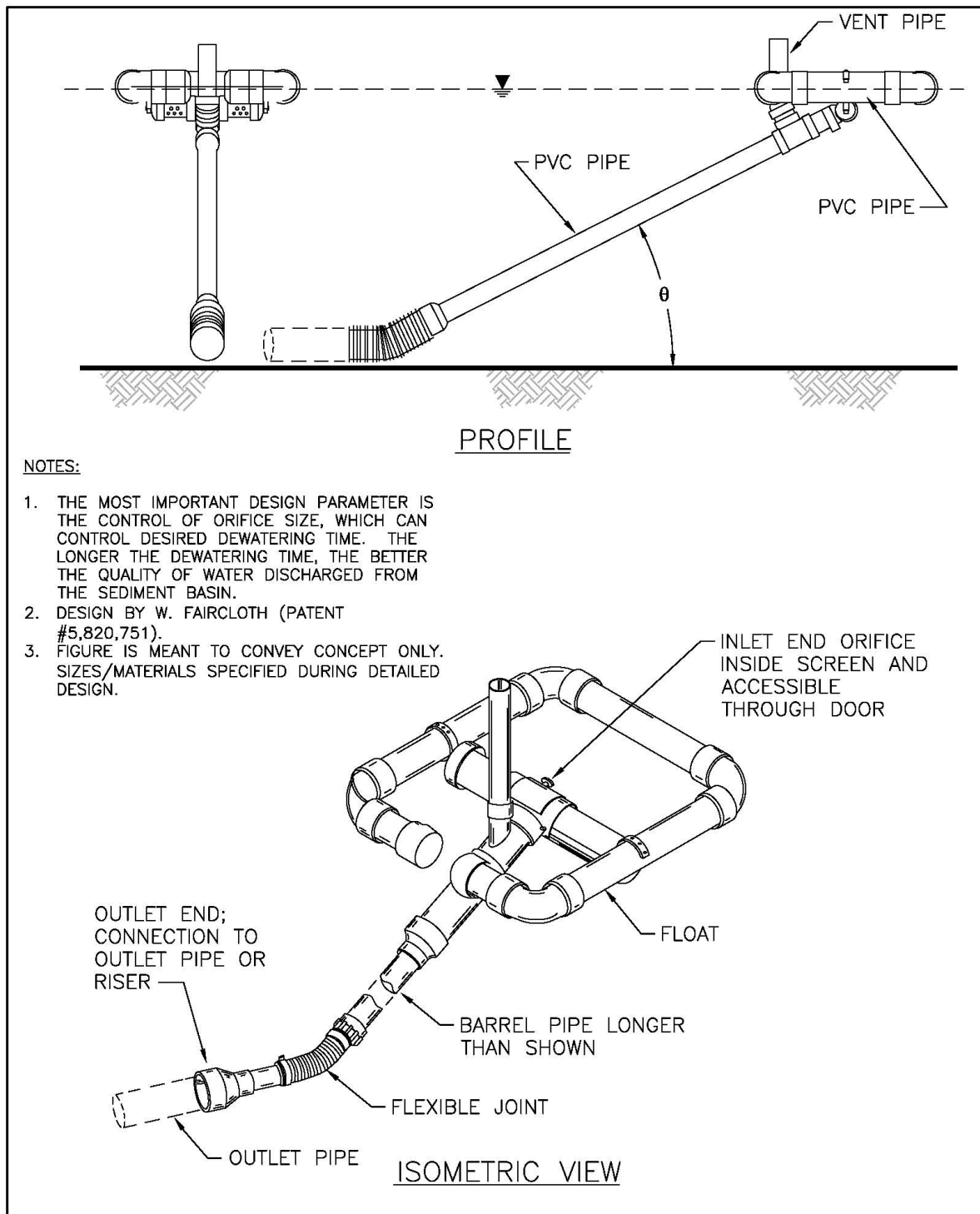
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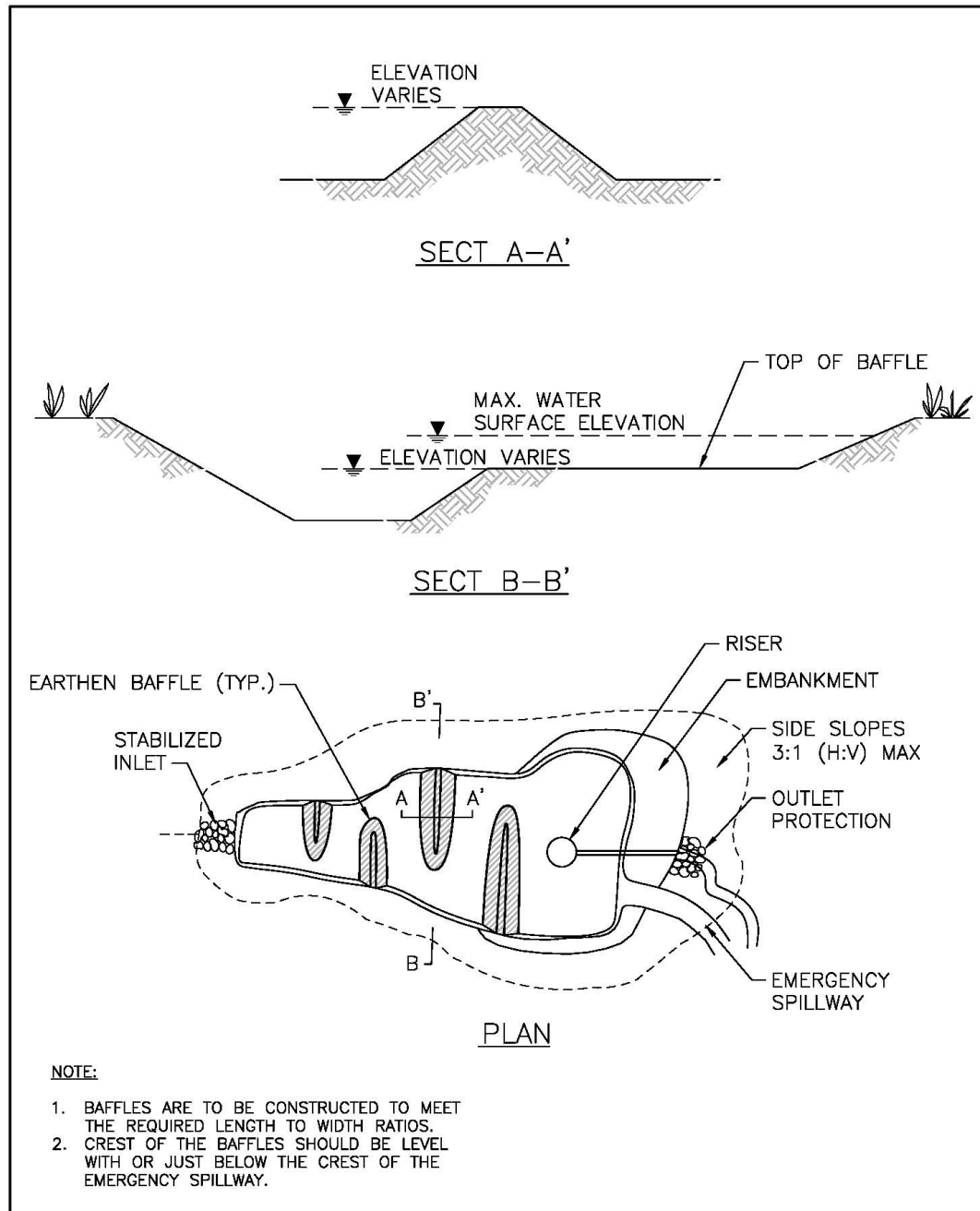
**FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN  
MULTIPLE ORIFICE DESIGN  
NOT TO SCALE**



**FIGURE 2: MULTIPLE ORIFICE OUTLET RISER**  
NOT TO SCALE

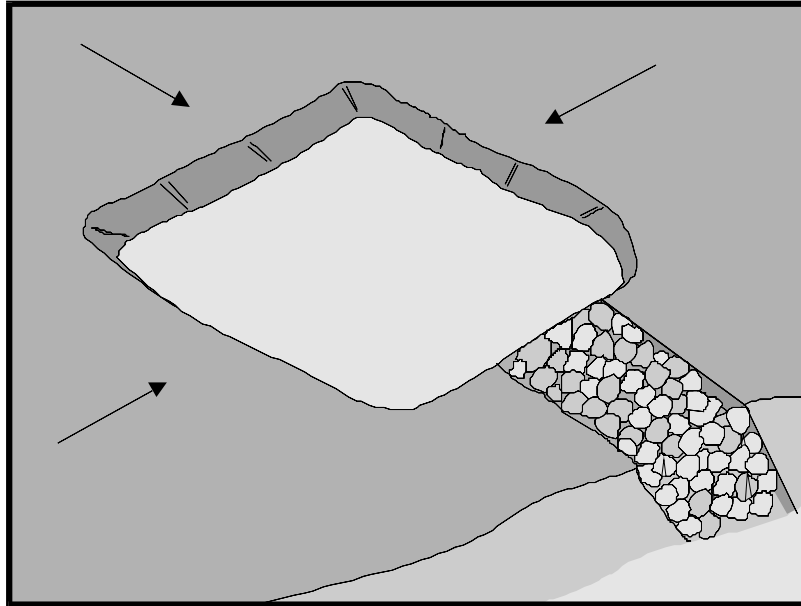


**FIGURE 3: TYPICAL SKIMMER**  
NOT TO SCALE



**FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN  
WITH BAFFLES  
NOT TO SCALE**





## Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged by gravity flow. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Trap design guidance provided in this fact sheet is not intended to guarantee compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment traps should be used in conjunction with a comprehensive system of BMPs.

## Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

SE-2 Sediment Basin (for larger areas)

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placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.

- As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

## Limitations

- Requires large surface areas to permit infiltration and settling of sediment.
- Not appropriate for drainage areas greater than 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

## Implementation

### Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume

the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criterion for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Trap should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd<sup>3</sup>/acre and 33 yd<sup>3</sup>/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and traps capable of impounding more than 35,000 ft<sup>3</sup>, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

## ***Installation***

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.

- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.
- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.
- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

## Costs

Average annual cost per installation is \$15 ft<sup>2</sup> and plus additional costs for the design and maintenance.

## Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect outlet area for erosion and stabilize if required.
- Inspect trap banks for seepage and structural soundness, repair as needed.
- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Inspect fencing for damage and repair as needed.
- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 96 hours or less to prevent vector production.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.
- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs per NS-2 shall be implemented at all times during dewatering activities.

## References

Brown, W., and T. Schueler. The Economics of Stormwater BMPs in the Mid-Atlantic Region. Prepared for Chesapeake Research Consortium, Edgewater, MD, by the Center for Watershed Protection, Ellicott City, MD, 1997.

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National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

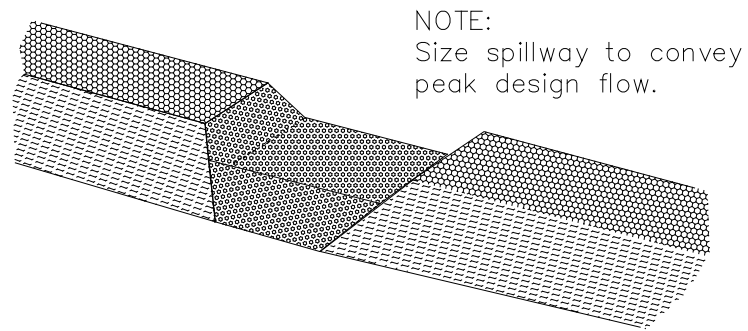
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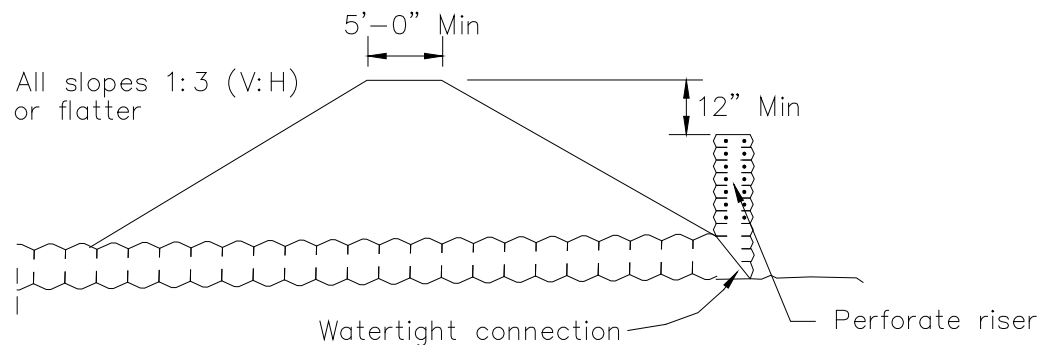
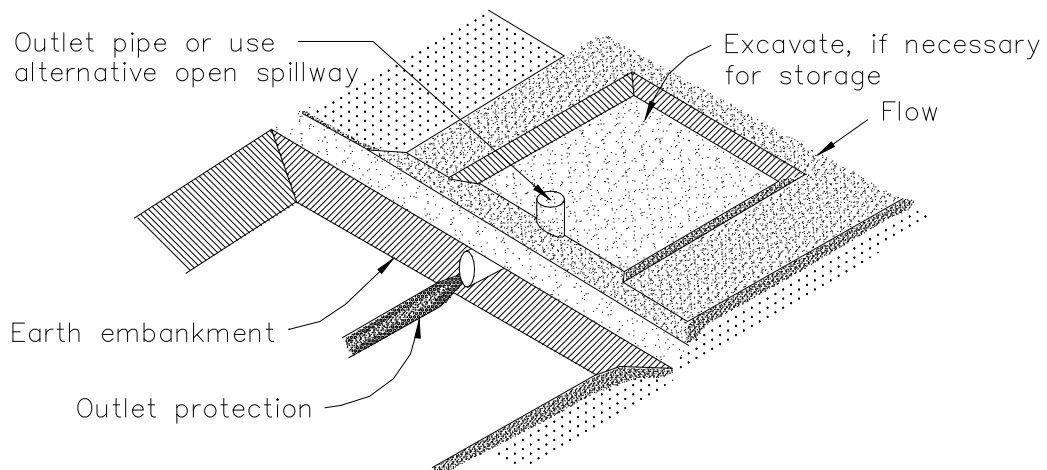
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Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



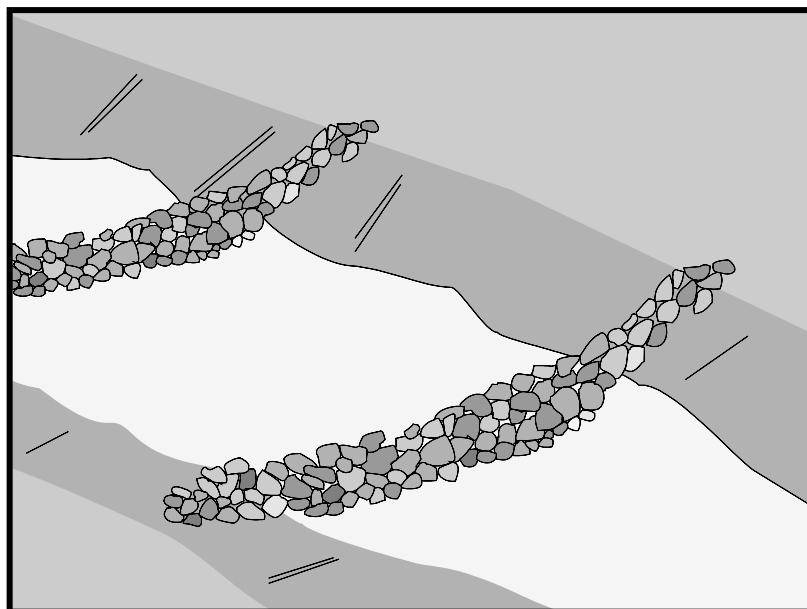
NOTE:  
Size spillway to convey  
peak design flow.

TYPICAL OPEN SPILLWAY



EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP  
NOT TO SCALE



## Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

## Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- During the establishment of grass linings in drainage ditches or channels.
- In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.
- To act as a grade control structure.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-12 Manufactured Linear Sediment Controls
- SE-14 Biofilter Bags

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## Limitations

- Not to be used in live streams or in channels with extended base flows.
- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion potential or sediment-laden flow is expected, as installation may damage vegetation.
- Require extensive maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.
- Do not construct check dams with straw bales or silt fence.
- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

## Implementation

### *General*

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as sediment controls. Note that use of 1-2 isolated check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

### *Design and Layout*

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity should be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a “permanent” ditch or swale being constructed early and used as a “temporary” conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, either:

- Don’t use check dams. Consider alternative BMPs, or.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam (see “Spacing Between Check Dams” detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of



the ditch or swale (see “Typical Rock Check Dam” detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet (see “Gravel Bag Check Dam” detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer’s instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- For multiple check dam installation, backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap should be cleaned following each storm event.

- High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.

## **Materials**

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.
- Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms.
- Sandbags used for check dams should conform to SE-8, Sandbag Barrier.
- Fiber rolls used for check dams should conform to SE-5, Fiber Rolls.
- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

## **Installation**

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Upper rows of gravel and sand bags shall overlap joints in lower rows.
- Fiber rolls should be trenched in, backfilled, and firmly staked in place.
- Install along a level contour.
- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

## **Costs**

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

## **Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

## References

Draft – Sedimentation and Erosion Control, and Inventory of Current Practices, USEPA, April 1990.

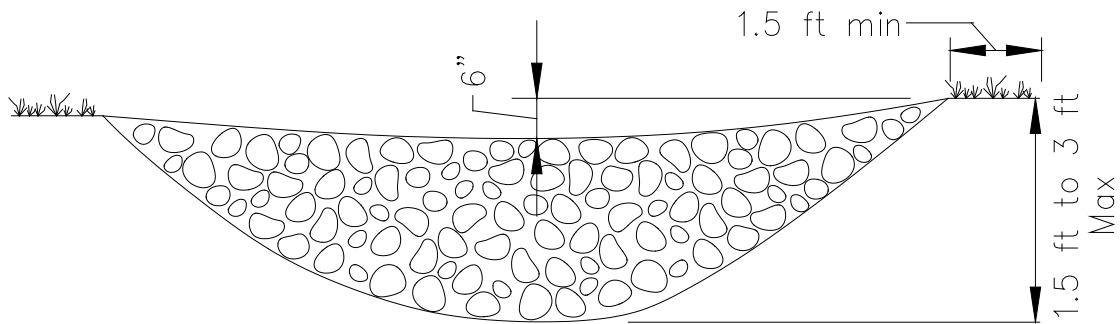
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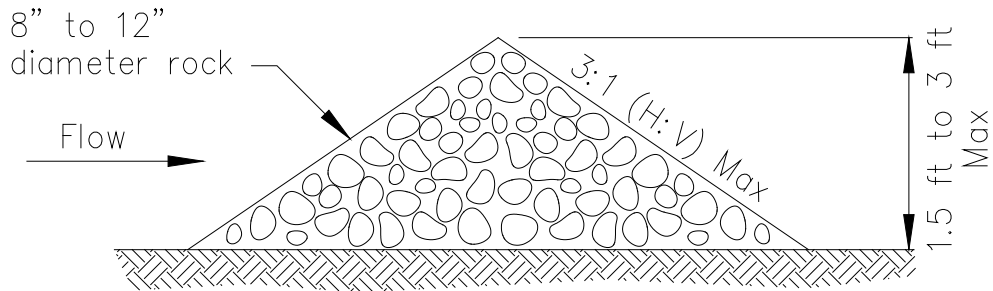
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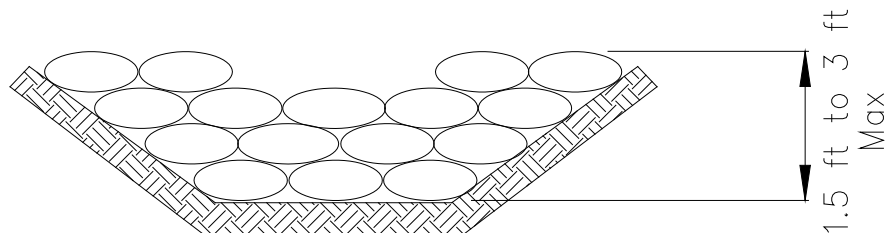


ELEVATION

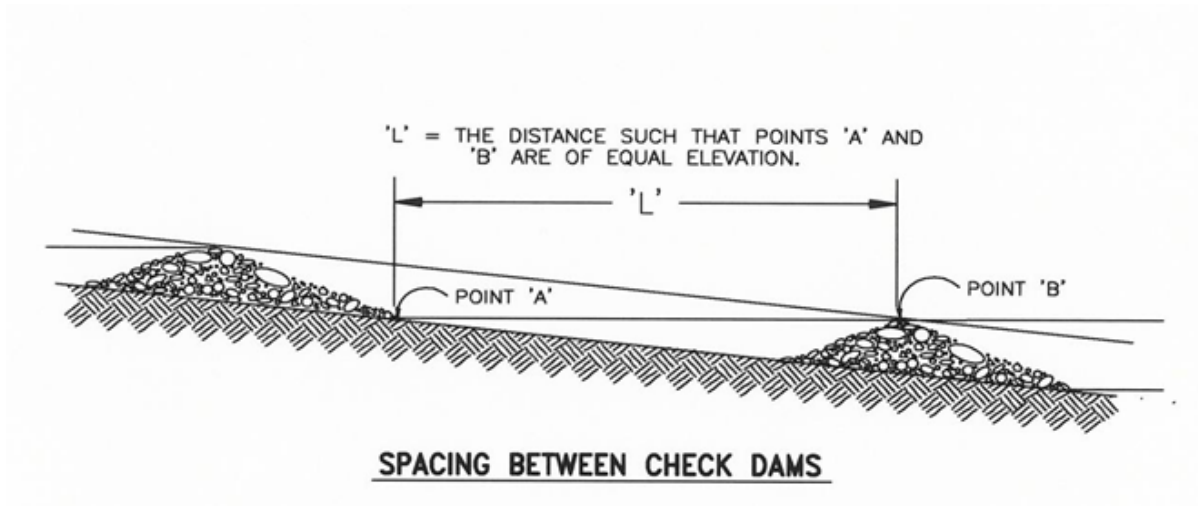


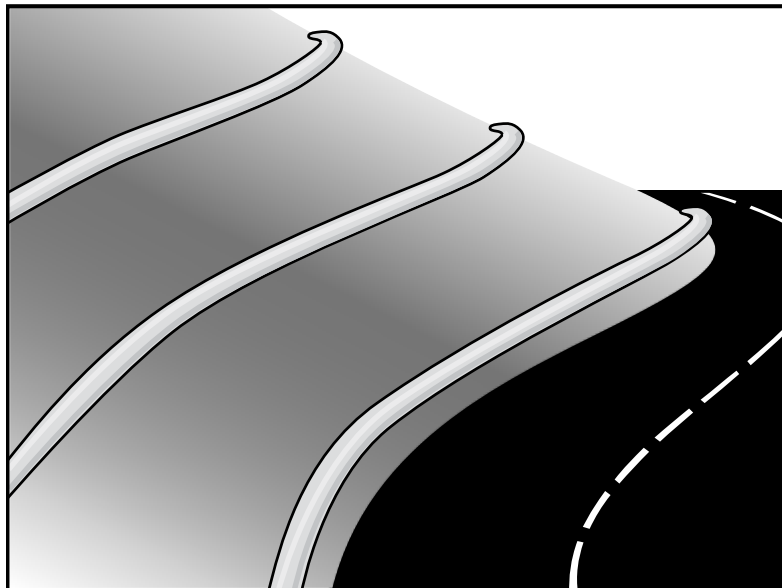
TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM  
NOT TO SCALE



GRAVEL BAG CHECK DAM ELEVATION  
NOT TO SCALE





## Description and Purpose

A fiber roll (also known as wattles or logs) consists of straw, coir, curled wood fiber, or other biodegradable materials bound into a tight tubular roll wrapped by plastic netting, which can be photodegradable, or natural fiber, such as jute, cotton, or sisal. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

## Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-1 Silt Fence
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-12 Manufactured Linear Sediment Controls
- SE-14 Biofilter Bags

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- At operational storm drains as a form of inlet protection.
- Around temporary stockpiles.

## Limitations

- Fiber rolls should be used in conjunction with erosion control, such as hydroseed, RECPs, etc.
- Only biodegradable fiber rolls containing no plastic can remain on a site applying for a Notice of Termination due to plastic pollution and wildlife concerns (State Water Board, 2016). Fiber rolls containing plastic that are used on a site must be disposed of for final stabilization.
- Fiber rolls are not effective unless trenched in and staked. If not properly staked and trenched in, fiber rolls will not work as intended and could be transported by high flows.
- Not intended for use in high flow situations (i.e., for concentrated flows).
- Difficult to move once saturated.
- Fiber rolls have a limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months, depending upon local conditions and roll material.

## Implementation

### *Fiber Roll Materials*

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed-free rice straw, flax, curled wood fiber, or coir bound into a tight tubular roll by netting or natural fiber (see *Limitations* above regarding plastic netting).
- Typical fiber rolls vary in diameter from 6 in. to 20 in. Larger diameter rolls are available as well. The larger the roll, the higher the sediment retention capacity.
- Typical fiber rolls lengths are 4, 10, 20 and 25 ft., although other lengths are likely available.

### *Installation*

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.

- Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
- Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be  $\frac{1}{4}$  to  $\frac{1}{3}$  of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.
- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

## **Removal**

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Fiber rolls encased with plastic netting or containing any plastic material will need to be removed from the site for final stabilization. Fiber rolls used in a permanent application are to be encased with a non-plastic material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance; therefore, during the BMP planning phase, the areas where fiber rolls will be used on final slopes, only fiber rolls wrapped in non-plastic material should be selected.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.



## Costs

Material costs for straw fiber rolls range from \$26 - \$38 per 25-ft. roll<sup>1</sup> and curled wood fiber rolls range from \$30 - \$40 per roll<sup>2</sup>.

Material costs for PAM impregnated fiber rolls range between \$9.00-\$12.00 per linear foot, based upon vendor research<sup>1</sup>.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.
- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.
- Repair any rills or gullies promptly.

## References

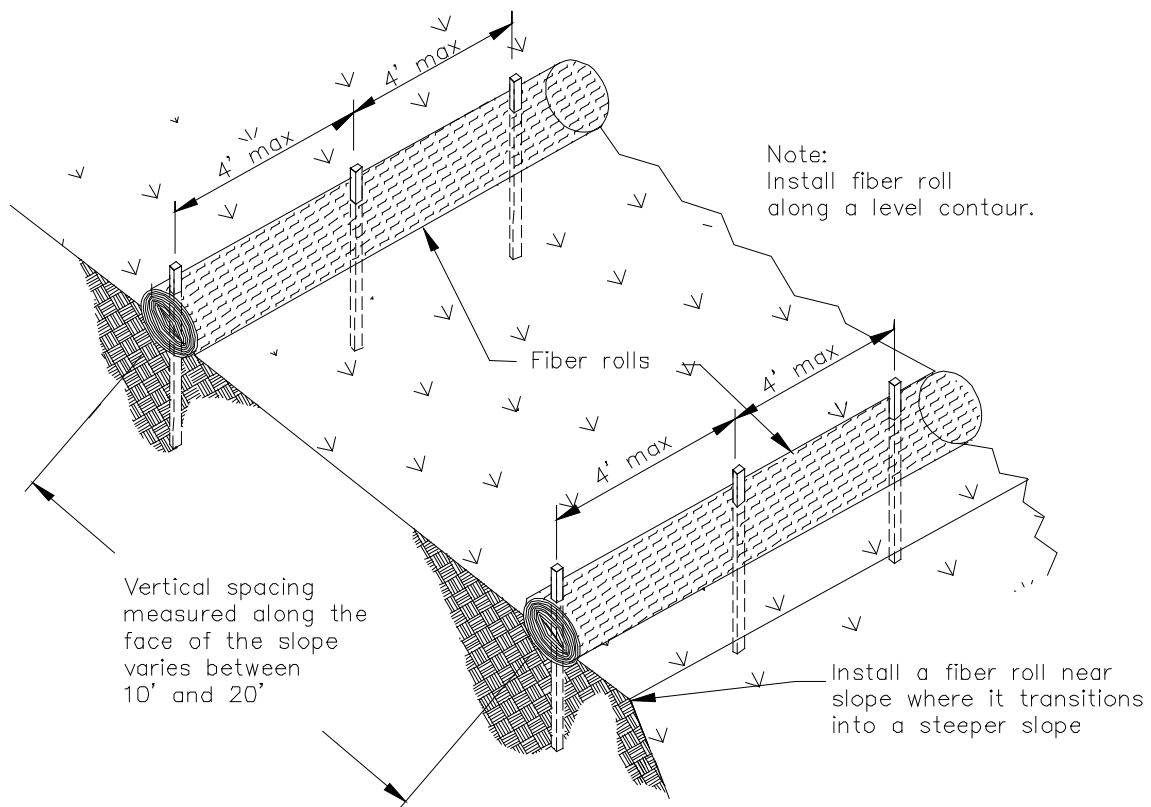
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Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

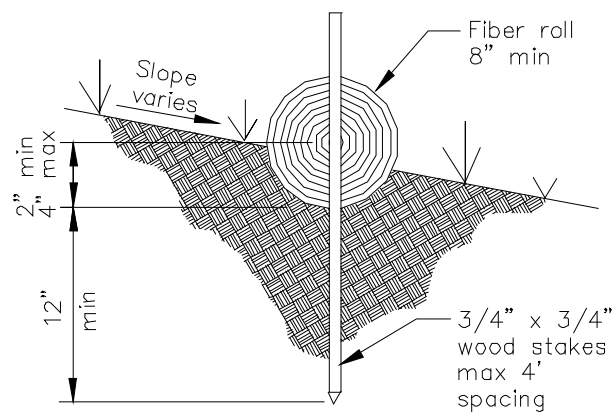
<sup>1</sup> Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

<sup>2</sup> Costs estimated based on vendor query by Tetra Tech, Inc. 2016.



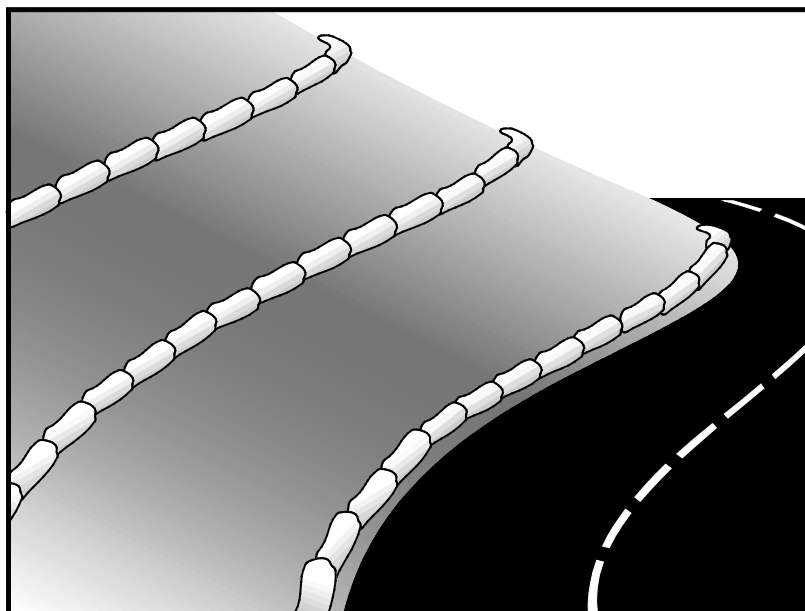
TYPICAL FIBER ROLL INSTALLATION

N.T.S.



ENTRENCHMENT DETAIL

N.T.S.



## Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flow, preventing erosion.

## Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As a linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Roll
- SE-8 Sandbag Barrier
- SE-12 Temporary Silt Dike
- SE-14 Biofilter Bags

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- At the top of slopes to divert runoff away from disturbed slopes.
- As chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

## Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the berm, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Durability of gravel bags is somewhat limited, and bags may need to be replaced when installation is required for longer than 6 months.
- Easily damaged by construction equipment.
- When used to detain concentrated flows, maintenance requirements increase.

## Implementation

### *General*

A gravel bag berm consists of a row of open graded gravel-filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers but are more porous. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

### *Design and Layout*

- Locate gravel bag berms on level contours.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more-layer construction
  - Top width = 12 in. minimum for one- or two-layer construction
  - Side slopes = 2:1 (H:V) or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more-layer construction.
  - Top width = 12 in. minimum for one- or two-layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

## **Materials**

- **Bag Material:** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd<sup>2</sup>, Mullen burst strength exceeding 300 lb/in<sup>2</sup> in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.

- **Bag Size:** Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal and may vary based on locally available materials.
- **Fill Material:** Fill material should be 0.5 to 1 in. Crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

## Costs

Material costs for gravel bags are average and are dependent upon material availability. \$3.20-\$3.80 per filled gravel bag is standard based upon vendor research (Adjusted for inflation, 2016 dollars, by Tetra Tech, Inc.).

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace gravel bags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

## References

Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



## Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

## Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

## Limitations

- Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).
- Sweeping may be less effective for fine particle soils (i.e., clay).

## Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused and perhaps save money.
- Inspect potential sediment tracking locations daily.

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None

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- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

## Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from \$ 650/day to \$2,500/day<sup>1</sup>, plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

## Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

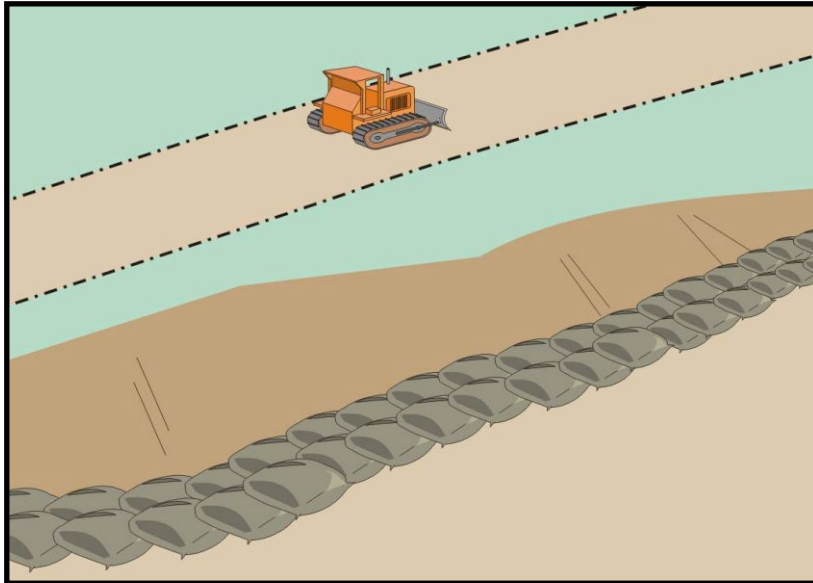
## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

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<sup>1</sup> Based on contractor query conducted by Tetra Tech, Inc. November 2016.





## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

<input checked="" type="checkbox"/>	<b>Primary Category</b>
<input checked="" type="checkbox"/>	<b>Secondary Category</b>

## Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

## Suitable Applications

Sandbag barriers may be a suitable control measure for the applications described below. It is important to consider that sand bags are less porous than gravel bags and ponding or flooding can occur behind the barrier. Also, sand is easily transported by runoff if bags are damaged or ruptured. The SWPPP Preparer should select the location of a sandbag barrier with respect to the potential for flooding, damage, and the ability to maintain the BMP.

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes.
  - As sediment traps at culvert/pipe outlets.
  - Below other small cleared areas.
  - Along the perimeter of a site.
  - Down slope of exposed soil areas.
  - Around temporary stockpiles and spoil areas.
  - Parallel to a roadway to keep sediment off paved areas.
  - Along streams and channels.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm
- SE-12 Manufactured Linear Sediment Controls
- SE-14 Biofilter Bags

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- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
  - At the top of slopes to divert runoff away from disturbed slopes.
  - As check dams across mildly sloped construction roads.

## Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Sandbags are not intended to be used as filtration devices.
- Easily damaged by construction equipment.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Durability of sandbags is somewhat limited, and bags will need to be replaced when there are signs of damage or wear.
- Burlap should not be used for sandbags.

## Implementation

### *General*

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding allows sediment to settle. Sand-filled bags have limited porosity, which is further limited as the fine sand tends to quickly plug with sediment, limiting or completely blocking the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms or SE-14, Biofilter Bags. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to gravel bag berms, but less porous. Generally, sandbag barriers should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

### *Design and Layout*

- Locate sandbag barriers on a level contour.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Sandbags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

- Slope inclination 2:1 (H:V) or greater: Sandbags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near the slope toe.
- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- Butt ends of bags tightly.
- Overlap butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more-layer construction
  - Side slope = 2:1 (H:V) or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more-layer construction.
  - Side slopes = 2:1 (H:V) or flatter.
- See typical sandbag barrier installation details at the end of this fact sheet.

## **Materials**

- **Sandbag Material:** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd<sup>2</sup>, Mullen burst strength exceeding 300 lb/in<sup>2</sup> in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap is not an acceptable substitute, as sand can more easily mobilize out of burlap.
- **Sandbag Size:** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal and may vary based on locally available materials.

- **Fill Material:** All sandbag fill material should be non-cohesive, Class 3 (Caltrans Standard Specification, Section 25) or similar permeable material free from clay and deleterious material, such as recycled concrete or asphalt.

## Costs

Empty sandbags cost \$0.25 - \$0.75. Average cost of fill material is \$8 per yd<sup>3</sup>. Additional labor is required to fill the bags. Pre-filled sandbags are more expensive at \$1.50 - \$2.00 per bag. These costs are based upon vendor research.

## Inspection and Maintenance

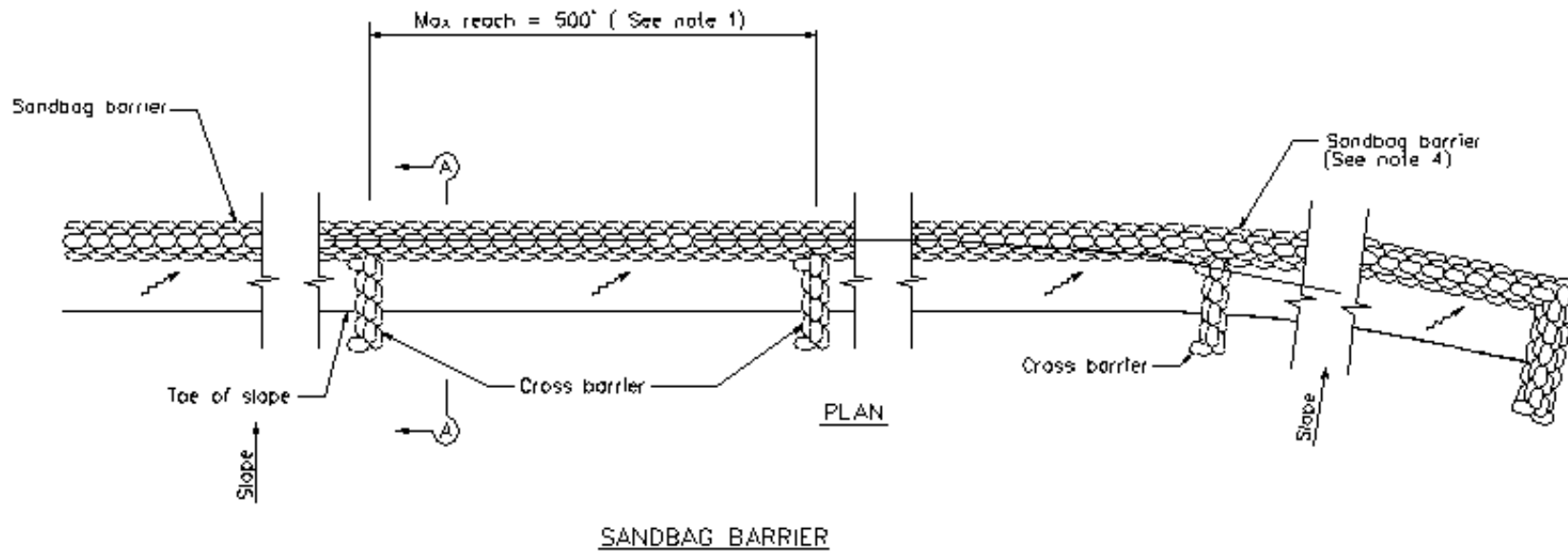
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

## References

Standard Specifications for Construction of Local Streets and Roads, California Department of Transportation (Caltrans), July 2002.

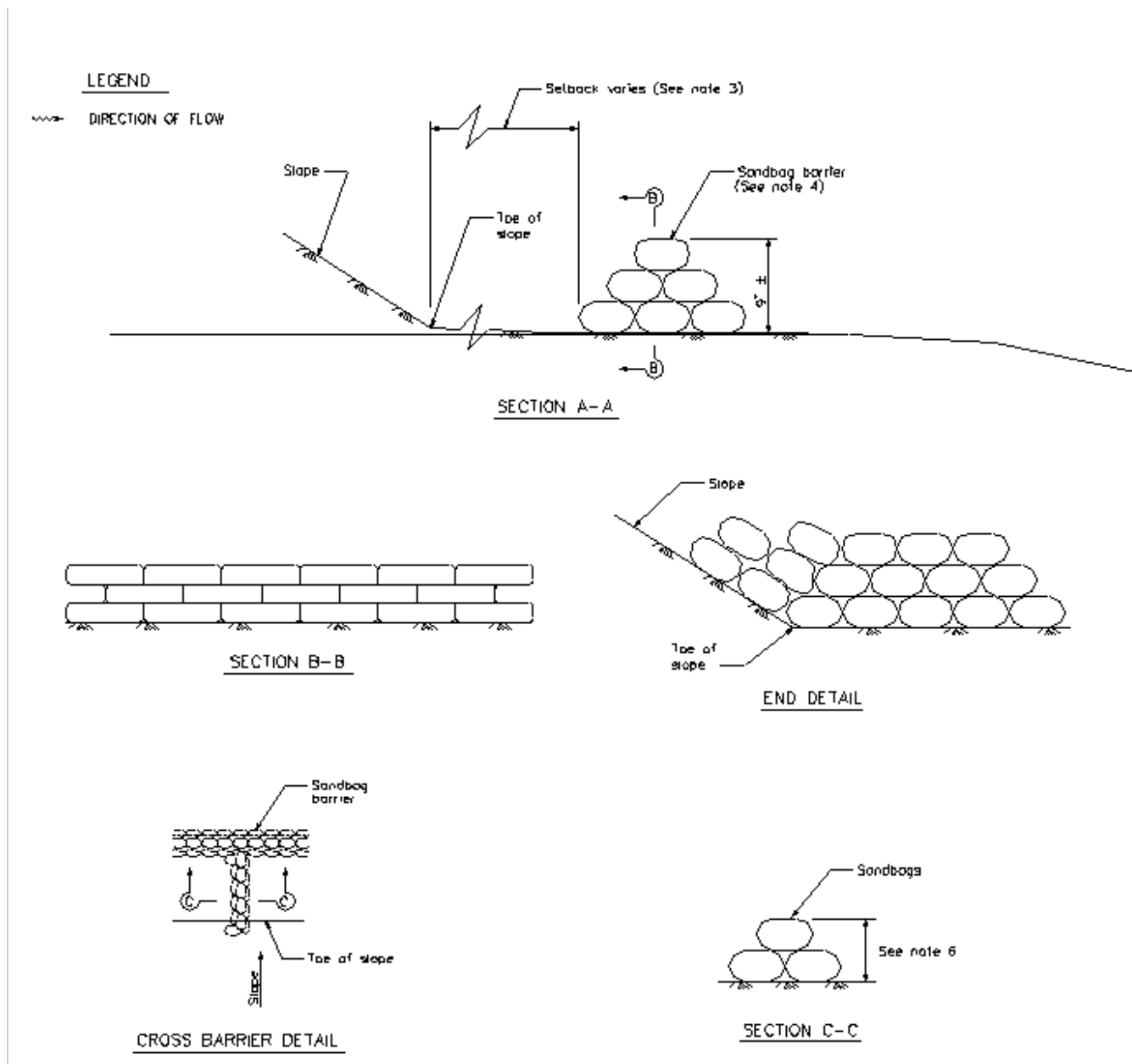
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

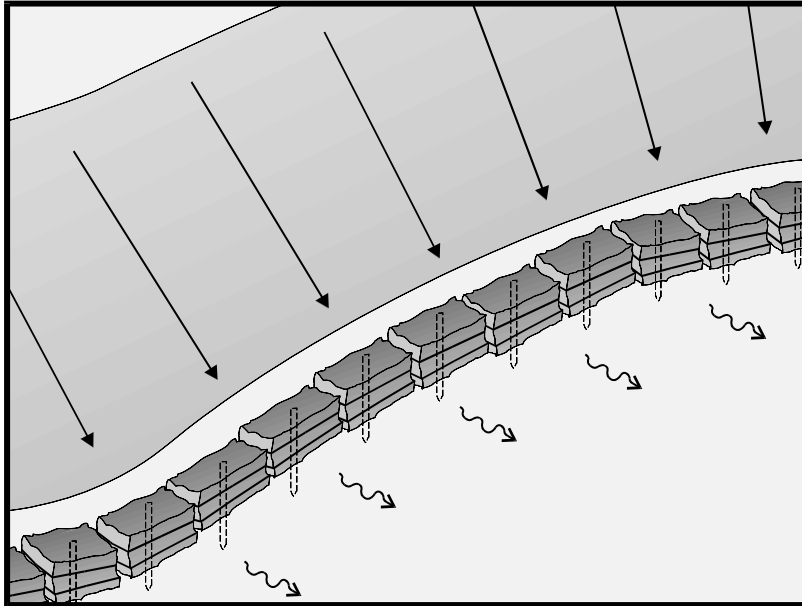
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



## NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed  $1/2$  the height of the linear barrier. In no case shall the reach length exceed 500'.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of  $1/2$  and a max of  $2/3$  the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.





## Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet-flow runoff, allowing sediment to settle out.

## Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

SE-1 Silt Fence  
 SE-5 Fiber Rolls  
 SE-6 Gravel Bag Berm  
 SE-8 Sandbag Barrier  
 SE-12 Temporary Silt Dike  
 SE-14 Biofilter Bags

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- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

## Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

## Implementation

### General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

### Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.



- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.
- Maximum flow path to the barrier should be limited to 100 ft.
- Straw bale barriers should consist of two parallel rows.
  - Butt ends of bales tightly
  - Stagger butt joints between front and back row
  - Each row of bales must be trenched in and firmly staked
- Straw bale barriers are limited in height to one bale laid on its side.
- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.
- See attached figure for installation details.

## Materials

- **Straw Bale Size:** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.
- **Bale Bindings:** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.
- **Stakes:** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

## Costs

Straw bales cost \$5 - \$7 each. Adequate labor should be budgeted for installation and maintenance.

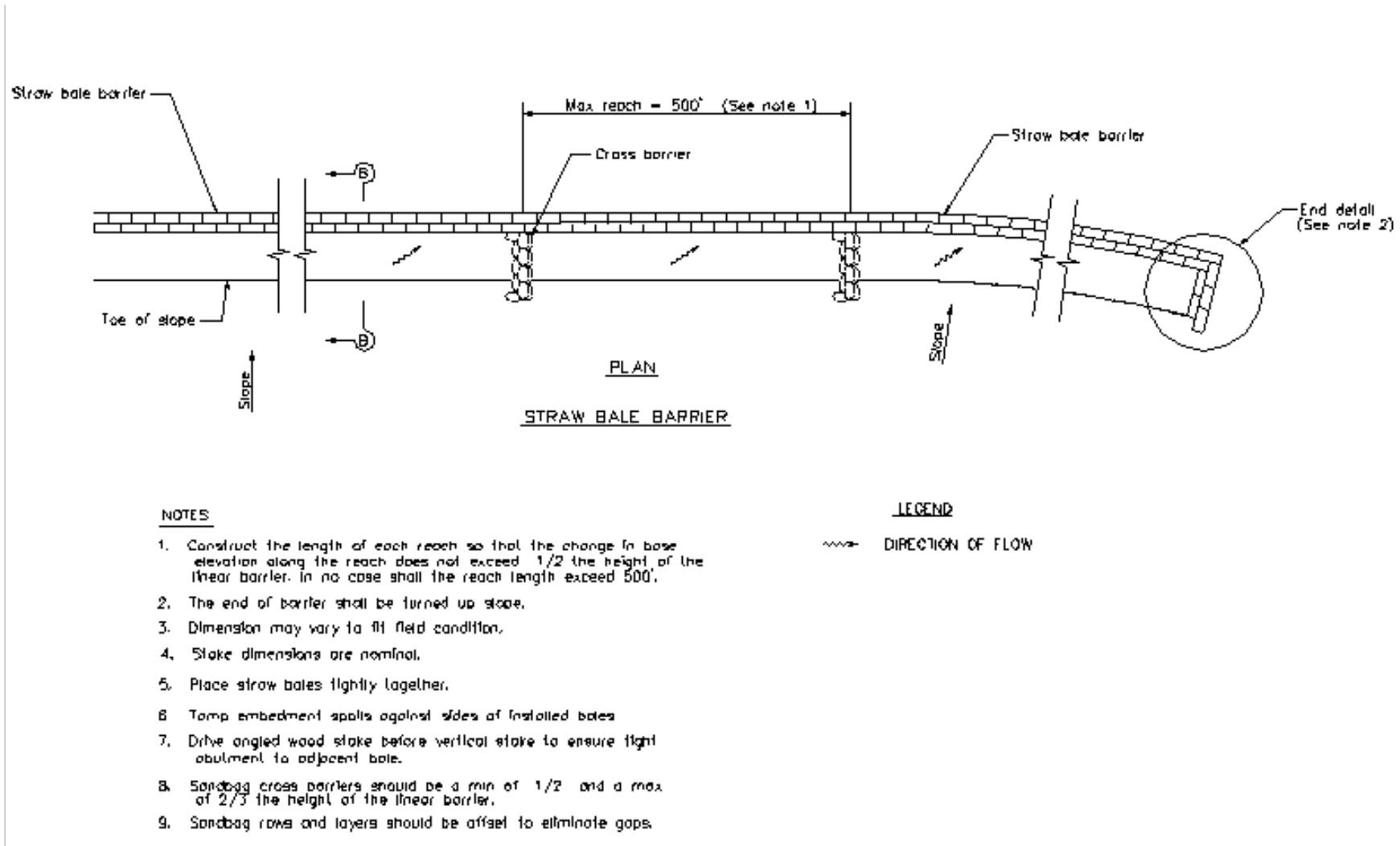
## Inspection and Maintenance

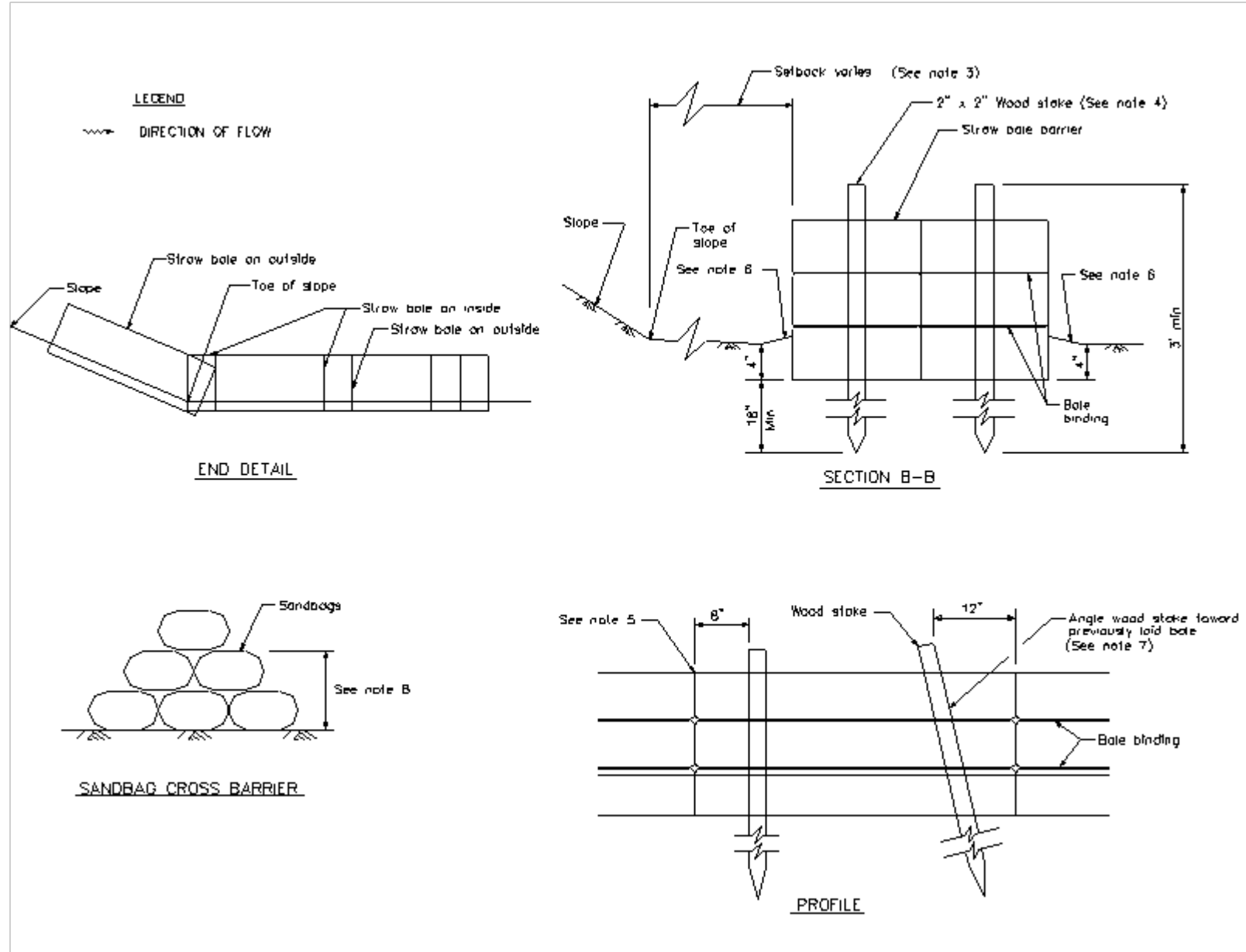
### *Maintenance*

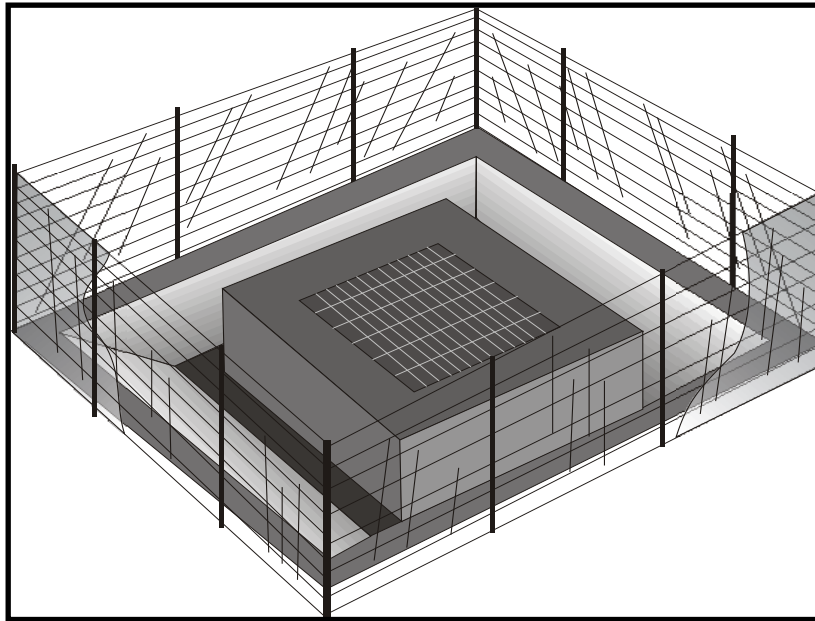
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.
- Replace or repair damaged bales as needed.
- Repair washouts or other damages as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.







## Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

## Suitable Applications

- Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

## Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Rolls
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-14 Biofilter Bags
- SE-13 Compost Socks and Berms

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other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

## Implementation

### *General*

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

### *Design and Layout*

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.
- Seven types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.

- Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
  - Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
  - Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
  - Compost Socks: Allow filtered run-off to pass through the compost while retaining sediment and potentially other pollutants (SE-13). Appropriate for flows under 1.0 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
  - Provide area around the inlet for water to pond without flooding structures and property.
  - Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
  - Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

## **Installation**

- **DI Protection Type 1 - Silt Fence** - Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.
- **DI Protection Type 2 - Excavated Drop Inlet Sediment Trap** - Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd<sup>3</sup>/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.
  - **DI Protection Type 3 - Gravel bag** - Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.
    1. Construct on gently sloping street.
    2. Leave room upstream of barrier for water to pond and sediment to settle.
    3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.
    4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10-year storm) should not overtop the curb.
  - **DI Protection Type 4 – Block and Gravel Filter** - Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.
    1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.
    2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
    3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
    4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.
  - **DI Protection Type 5 – Temporary Geotextile Insert (proprietary)** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable, and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.



- **DI Protection Type 6 - Biofilter bags** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.
  1. Construct in a gently sloping area.
  2. Biofilter bags should be placed around inlets to intercept runoff flows.
  3. All bag joints should overlap by 6 in.
  4. Leave room upstream for water to pond and for sediment to settle out.
  5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.
- **DI Protection Type 7 – Compost Socks** – A compost sock can be assembled on site by filling a mesh sock (e.g., with a pneumatic blower). Compost socks do not require special trenching compared to other sediment control methods (e.g., silt fence). Compost socks should conform to specification detailed in SE-13, Compost Socks and Berms.

## Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one-year useful life) is \$200 per inlet.
- Temporary geotextile inserts are proprietary, and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from \$50-75 plus installation, but costs can exceed \$100. This cost does not include maintenance.
- See SE-13 for Compost Sock cost information.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

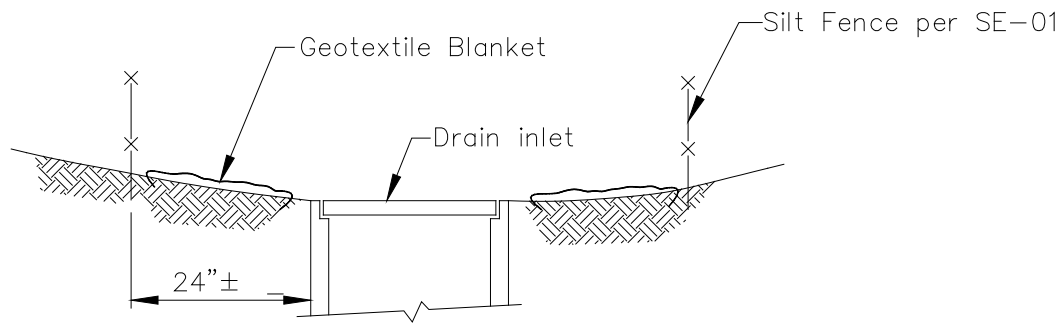
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.
  - Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

## References

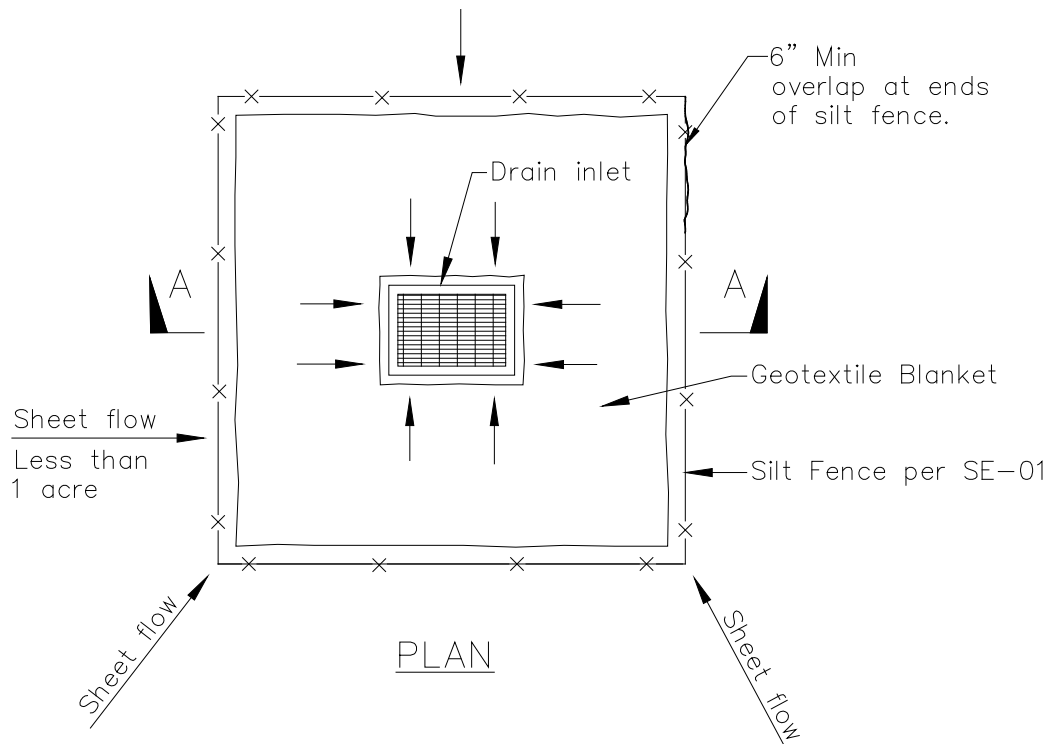
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A-A

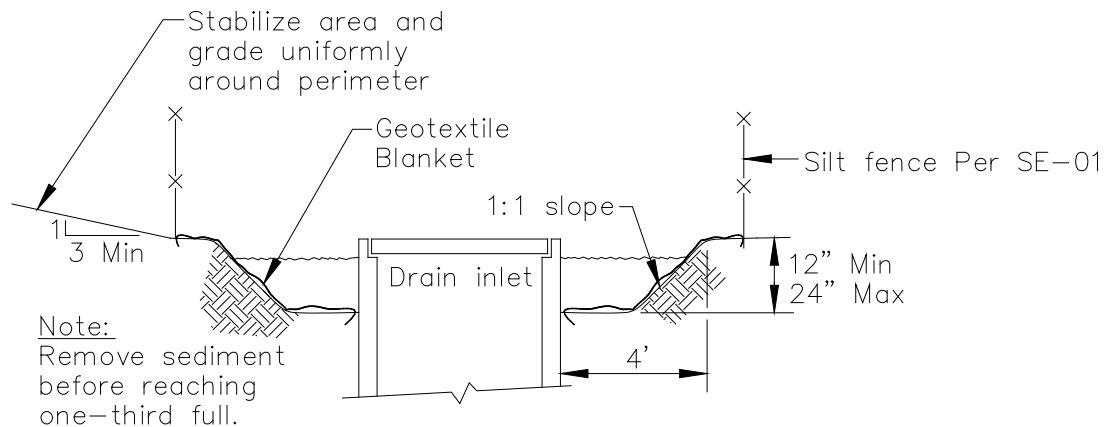


PLAN

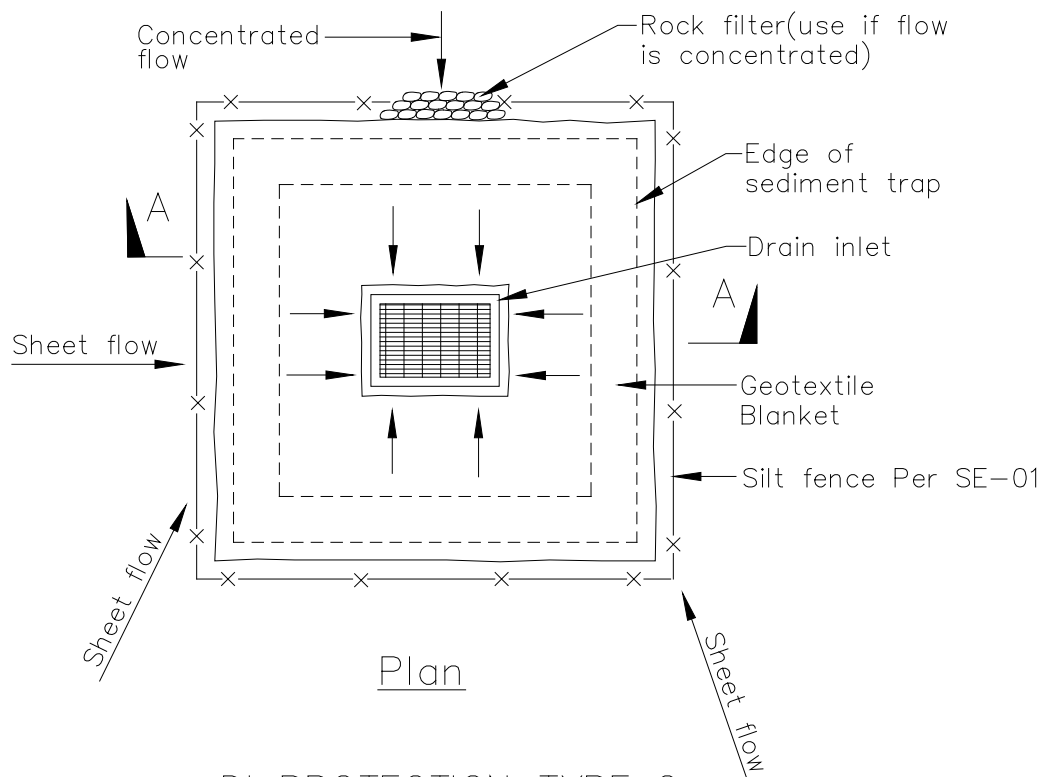
DI PROTECTION TYPE 1  
NOT TO SCALE

## NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



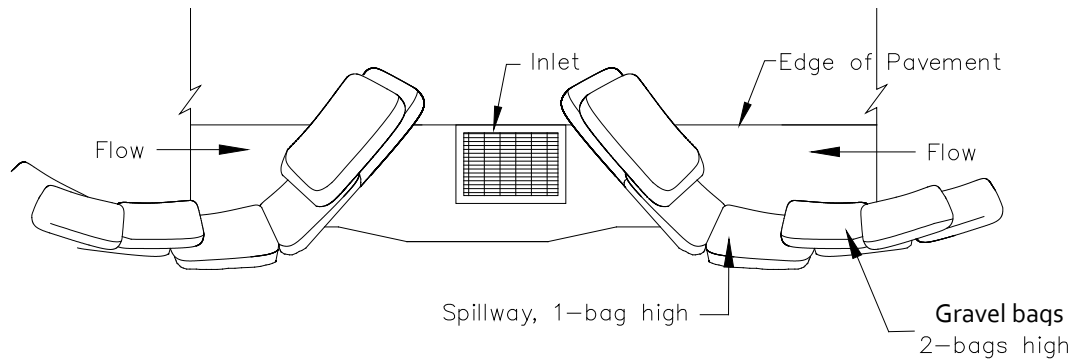
Section A-A



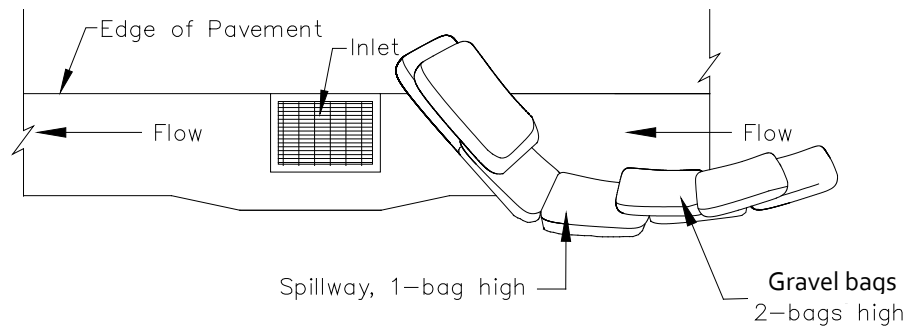
DI PROTECTION TYPE 2  
NOT TO SCALE

## Notes

1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

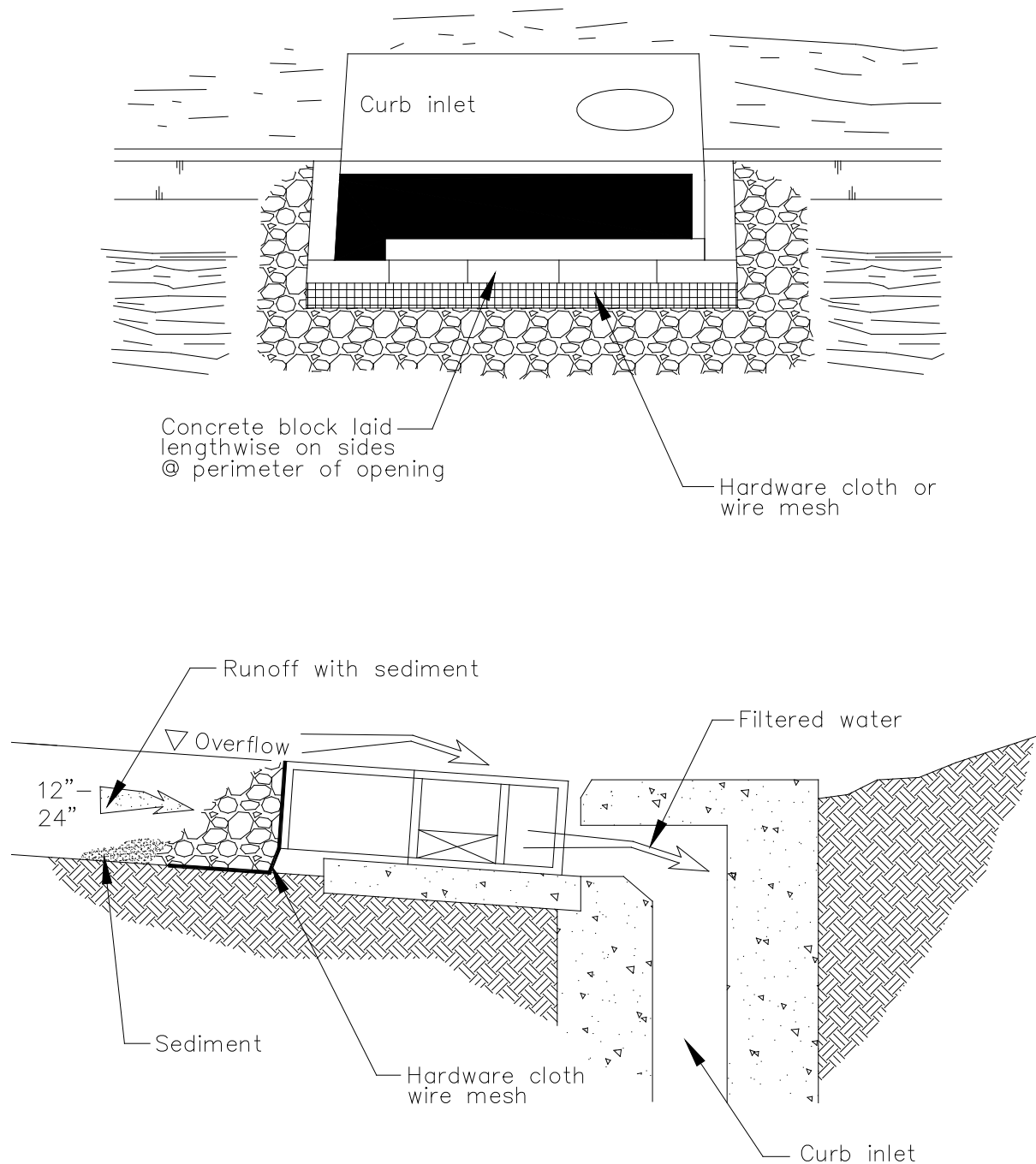


TYPICAL PROTECTION FOR INLET ON GRADE

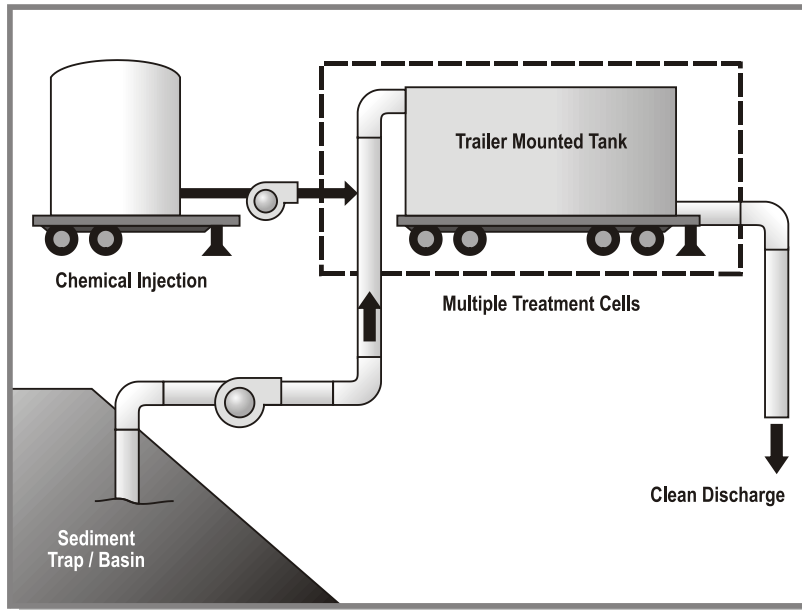
NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.
6. Protection can be effective even if it is not immediately adjacent to the inlet provided that the inlet is protected from potential sources of pollution.

DI PROTECTION TYPE 3  
NOT TO SCALE



DI PROTECTION — TYPE 4  
NOT TO SCALE



## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Category
- ☒ Secondary Category

## Description and Purpose

Active Treatment Systems (ATS) reduce turbidity of construction site runoff by introducing chemicals to stormwater through direct dosing or an electrical current to enhance flocculation, coagulation, and settling of the suspended sediment. Coagulants and flocculants are used to enhance settling and removal of suspended sediments and generally include inorganic salts and polymers (USACE, 2001). The increased flocculation aids in sedimentation and ability to remove fine suspended sediments, thus reducing stormwater runoff turbidity and improving water quality.

## Suitable Applications

ATS can reliably provide exceptional reductions of turbidity and associated pollutants and should be considered where turbid discharges to sediment and turbidity sensitive waters cannot be avoided using traditional BMPs. Additionally, it may be appropriate to use an ATS when site constraints inhibit the ability to construct a correctly sized sediment basin, when clay and/or highly erosive soils are present, or when the site has very steep or long slope lengths.

## Limitations

Dischargers choosing to utilize chemical treatment in an ATS must follow all guidelines of the Construction General Permit Attachment F – Active Treatment System Requirements. General limitations are as follows:

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Numeric Effluent Limit (NEL) for all discharges (10 NTU daily flow-weighted average)
- Limited availability of chemical residual testing procedures that meet permit requirements for flow-through treatment
- Specific field and classroom ATS training required to operate equipment
- Batch treatment requires extensive toxicity testing of effluent
- Batch treatment requires large footprint to accommodate treatment cells
- Requires additional filtration to remove residual floc and treatment chemicals prior to discharge
- Petroleum based polymers should not be used
- Requires site-specific design and equipment
- Limited discharge rates depending on receiving water body
- Labor intensive operation and maintenance
- ATS costs are higher on a unit basis for smaller sites that would be expected to have a lower volume of treated runoff
- ATS costs are seasonably variable due to increases or decreases in rainfall volumes

## Implementation

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling but are ineffective at removing smaller particulates such as clay and fine silt. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). ATS may be used to reduce the turbidity of stormwater runoff. With an ATS, very high turbidities can be reduced to levels comparable to what is found in streams during dry weather.

## Criteria for ATS Product Use

Chemically treated stormwater discharged from construction sites must be non-toxic to aquatic organisms. The following protocol should be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- An ATS Plan, which includes an Operation and Maintenance component, a Monitoring, Sampling and Reporting component, a Health and Safety component, and a Spill Prevention component must be prepared and submitted to the Regional Water Quality Control Board (RWQCB).



- Treatment chemicals should be approved by EPA for potable water use or otherwise be demonstrated to be protective of human health and the environment. Chemical residual or whole effluent toxicity testing is required.
- Prior to field use of chemical treatment, jar tests are to be conducted to demonstrate that turbidity reduction necessary to meet the NELs and receiving water criteria can be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions. Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability. A minimum of six site-specific jar tests must be conducted per chemical.
- The proposed maximum dosage should be at least a factor of five lower than the no observed effects concentration (NOEC).
- Effluent discharge from an ATS to a receiving water is conditional upon the favorable results of full-scale whole effluent bioassay/toxicity testing for batch treatment systems and upon chemical residuals testing for flow-through systems.
- Contact the RWQCB for a list of treatment chemicals that may be pre-approved for use.

## ***Active Treatment System Design Considerations***

The design and operation of an ATS should take into consideration the factors that determine optimum, cost-effective performance. While site characteristics will influence system design, it is important to recognize the following overriding considerations:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is an optimum dosage rate. This is a situation where the adage “adding more is always better” is not the case.
- The coagulant must be mixed rapidly into the water to insure proper dispersion.
- The mixing system for batch treatment must be sized to provide adequate mixing for the design storage volume. Lack of adequate mixing during the flocculation phase results in flocs that are too small and/or insufficiently dense. Too much mixing can rapidly destroy floc as it is formed.
- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a filtration system such as sand, bag, or cartridge filter that would catch any unintended floc discharge.
- ATS is also regulated for pH of the discharge. A pH-adjusting chemical should be added into the treated water to control pH if the selected coagulant requires alteration of the pH of the discharge outside of the acceptable range.

## ***Active Treatment System Design***

ATS can be designed as batch treatment systems using either ponds or portable trailer-mounted tanks, or as flow-through systems using any number of proprietary designed systems.

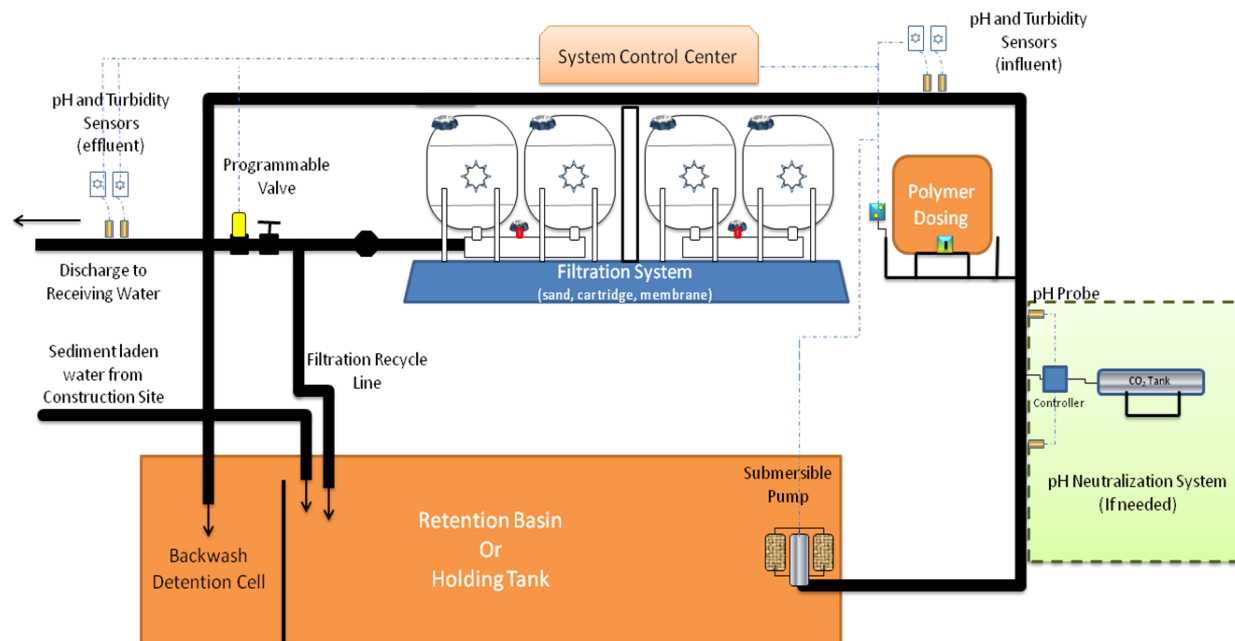


Figure has been adapted from Port of Seattle response to Washington Dept. of Ecology Action Order 2948

## Batch Treatment

Batch Treatment systems consist of the stormwater collection system (either temporary diversion or the permanent site drainage system); a sediment basin, trap or holding tanks; pumps; a chemical feed system; treatment cells; and, interconnecting piping.

Batch treatment systems should use a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be basins, traps, or tanks. Portable tanks may also be suitable for some sites.

The following equipment should be located in a secured, covered location:

- The chemical injector
- Secondary contaminant for acid, caustic, buffering compound, and treatment chemical
- Emergency shower and eyewash
- Monitoring equipment which consists of a pH meter and a turbidimeter (if not already within the instrumentation panel of the chemical injector)

## Flow-through Treatment

At a minimum, a flow-through ATS system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), an untreated stormwater storage pond or holding tank, and a chemically enhanced filtration system.

Stormwater is collected at interception point(s) on the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area.

The stormwater is stored until treatment occurs. It is important that the holding pond be large enough to provide adequate storage.

Stormwater is then pumped from the untreated stormwater storage pond to the chemically enhanced filtration system where polymer is added. Adjustments to pH may be necessary before chemical addition. The filtration system continually monitors the stormwater for turbidity and pH. If the discharge water is out of the acceptable turbidity or pH range, the water is recycled to the untreated stormwater pond (or holding tank) where it can be retreated. Flow through systems must ensure that:

- Cumulative flow volume shall be recorded daily. The data recording system shall have the capacity to record a minimum of seven days of continuous data.
- Instrumentation systems are interfaced with system control to provide auto shutoff or recirculation in the event that effluent measurements exceed turbidity or pH.
- Upon system upset, power failure, or other catastrophic event, the ATS will default to a recirculation mode or safe shut down.
- The instrumentation system provides a method for controlling coagulant dose, to prevent potential overdosing.

## ***Sizing Criteria***

An ATS shall be designed and approved by a Certified Professional in Erosion and Sediment Control (CPESC), a Certified Professional in Storm Water Quality (CPSWQ); a California registered civil engineer; or any other California registered engineer.

ATS must be designed to capture and treat (within 72 hours) runoff from the 10-year 24-hour storm event. The runoff volume of the watershed area to be treated from this size storm event is required to be calculated using the Rational Method with a runoff coefficient of 1.

If sediment basins are used to capture flow-through or batch treatment, see SE-2, Sediment Basin, for design criteria. Bypass should be provided around the ATS to accommodate extreme storm events. Primary settling should be encouraged in the sediment basin/storage pond. A forebay with access for maintenance may be beneficial.

The permissible discharge rate governed by potential downstream effect should be used to calculate the recommended size of the treatment cells. Local requirements related to Phase I or Phase II NPDES permit thresholds should be considered in developing maximum discharge rates the ATS Plan.

## **Costs**

Costs for ATS may be significant due to equipment rental requirements and cost of chemicals. ATS cost is lower on a treated unit-basis for large construction sites with large volumes of runoff.

## **Inspection and Maintenance**

ATS must be operated and maintained by individuals with experience in their use and trained in accordance with training requirements below. ATS should be monitored continuously while in

use. A designated responsible person shall be on site daily at all times during treatment operations. Daily on-site visual monitoring of the system for proper performance shall be conducted and recorded in the project data log. The name, phone number, and training documentation of the person responsible for system operation and monitoring shall be included in the project data log.

The following monitoring requirements and results should be recorded in the data log:

## ***Operational and Compliance Monitoring***

- Effluent flow rate and volume shall be continuously monitored and recorded at 15- minute or less intervals.
- Influent and effluent pH must be continuously monitored and recorded at 15-minute or less intervals.
- Influent and effluent turbidity (expressed in NTU) must be continuously monitored and recorded at 15-minute or less intervals.
- The type and amount of chemical used for pH adjustment, if any, shall be monitored and recorded.
- Dose rate of chemical used in the ATS system (expressed in mg/L) shall be monitored and reported 15-minutes after startup and every 8 hours of operation.
- Laboratory duplicates – monthly laboratory duplicates for residual coagulant analysis must be performed and records shall be maintained onsite.
- Effluent shall be monitored and recorded for residual chemical/additive levels.
- If a residual chemical/additive test does not exist and the ATS is operating in a batch treatment mode of operation refer to the toxicity monitoring requirements below.

## ***Toxicity Monitoring***

### **Batch Treatment**

Toxicity testing for systems operated in batch treatment mode should be made in accordance with the following:

- Acute toxicity testing on effluent samples representing effluent from each batch prior to discharge shall be undertaken. All bioassays shall be sent to a laboratory certified by the Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP). The required field of testing number for Whole Effluent Toxicity (WET) testing is E113.
- Acute toxicity tests shall be conducted with the following species and protocols. The methods to be used in the acute toxicity testing shall be those outlined for a 96-hour acute test in “Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, USEPA-841-R-02-012” for Fathead minnow, *Pimephales promelas*. Rainbow trout, *Oncorhynchus mykiss*, may be used as a substitute for fathead minnow.

All toxicity tests shall meet quality assurance criteria and test acceptability criteria in the most recent versions of the EPA test method for WET testing.

## Flow-through Treatment

Toxicity testing for systems operated in flow-through treatment mode should be made in accordance with the following:

- A residual chemical test method shall be used that has a method detection limit (MDL) of 10% or less than the maximum allowable threshold concentration (MATC) for the specific coagulant in use and for the most sensitive species of the chemical used. The MATC is equal to the geometric mean of the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) Acute and Chronic toxicity results for most sensitive species determined for the specific coagulant.
- The residual chemical test method shall produce a result within one hour of sampling.
- A California State certified laboratory shall validate the selected residual chemical test. Specifically, the lab will review the test protocol, test parameters, and the detection limit of the coagulant. The discharger shall electronically submit this documentation as part of the ATS Plan.

## ***Numeric Effluent Limit (NEL) Compliance:***

All chemically treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits have been established by the Construction General Permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity limits have been set as 10 NTU as a daily flow-weighted average or 20 NTU from a single sample. pH must be within the range of 6.0 to 9.0 standard units. It is often possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements should be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water should not be taken from the treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

## ***Operator Training:***

Operators shall have training specific to using an ATS and liquid coagulants for stormwater discharges in California. The training shall be in the form of a formal class with a certificate and requirements for testing and certificate renewal. Training shall include a minimum of eight hours classroom and 32 hours field training.

## ***Standard BMPs:***

Erosion and sediment control BMPs should be implemented throughout the site to prevent erosion and discharge of sediment to the ATS. Some types of chemical coagulation and flocculation are only achievable in water below a certain turbidity; therefore, minimizing the amount of sediment reaching the system will increase the likelihood of meeting effluent limits and will potentially lower costs of chemical dosing.

## ***Sediment Removal and Disposal***

- Sediment shall be removed from the storage or treatment cells as necessary to ensure that the cells maintain their required water storage (i.e., volume) capability.
- Handling and disposal of all solids generated during ATS operations shall be done in accordance with all local, state, and federal laws and regulations.
- If sediment is determined to be non-toxic, it may be incorporated into the site away from drainages.

## **References**

Engineering and Design – Precipitation/Coagulation/Flocculation. United States Army Corps of Engineers, EM 1110-1-4012, 2001.

Evaluation of Active Treatment Systems (ATS) for Construction Site Runoff. California Building and Industry Association (prepared by Geosyntec Consultants), 2008.

Stormwater Management Manual for Western Washington, Volume II – Construction Stormwater Pollution Prevention, Washington State Department of Ecology, August 2001.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

# Manufactured Linear Sediment Controls (MLSC)

## SE-12



### Description and Purpose

Manufactured linear sediment controls (MLSC) are pre-manufactured devices that are typically specified and installed for drainage and sediment control on the perimeter of disturbed sites or stockpiles and as check dams within channels. Typically, MLSCs can be reused.

This fact sheet is intended to provide guidance on BMP selection and implementation of proprietary or vendor-supplied products, for sediment control. Products should be evaluated for project-specific implementation and used if determined to be appropriate by the SWPPP Preparer.

### Suitable Applications

MLSCs are generally used in areas as a substitute for fiber rolls and silt fences in sediment control applications to slow down runoff water, divert drainage or contain fines and sediment. MLSCs are a linear control and application suitability varies based on the specific product type. They may be suitable:

- On paved surfaces for perimeter protection.
- As check structures in channels.
- Along the perimeter of disturbed sites in lieu of silt fence.

### Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

### Legend:

- ☒ Primary Category
- ☒ Secondary Category

### Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	

### Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Roll
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier

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# Manufactured Linear Sediment Controls (MLSC)

## SE-12

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- At operational storm drains as a form of inlet protection.
- Around temporary stockpiles or material/equipment storage areas.
- At the interface between graveled driveways and pavement.
- Along the toe of exposed and erodible slopes.

### Limitations

- Limitations vary by product. Product manufacturer's printed product use instructions should be reviewed by the SWPPP Preparer to determine the project-specific applicability of MLSCs.

### Implementation

#### *General*

When appropriately placed, MLSCs intercept and slow sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The device is porous, which allows the ponded runoff to flow slowly through the device, releasing the runoff as sheet flows. Generally, MLSCs should be used in conjunction with temporary soil stabilization controls up-slope to provide an effective combination of erosion and sediment control.

#### *Design and Layout*

- MLSCs used on soil should be trenched or attached to the ground per manufacturer specifications in a manner that precludes runoff or ponded water from flowing around or under the device.
- MLSCs designed for use on asphalt or concrete may be attached using a variety of methods, including nailing the device to the pavement, or using a high strength adhesive.
- Follow manufacturer written specifications when installing MLSCs.
- Allow sufficient space up-slope from the silt dike to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, MLSCs should be set back 3 feet from the slope toe to facilitate cleaning. Where site conditions do not allow set back, the sediment control may be constructed on the toe of the slope. To prevent flows behind the barrier, sand or gravel bags can be placed perpendicular and between the sediment control and slope to serve as a barrier to parallel flow.
- Drainage area should not exceed 5 acres.

#### *Materials*

- Several manufactured products are available. The following search terms or combination of terms can be used with an internet search engine to find manufactured linear sediment controls:



# Manufactured Linear Sediment Controls (MLSC)

## SE-12

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- “silt barrier”
- “reusable silt fence”
- “silt fence alternative” or
- “perimeter sediment control”

### Costs

Manufacturers should be contacted directly for current pricing.

### Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Reshape or replace sections of damaged MLSCs as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove MLSCs when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of properly.

### References

City of Elko Construction Site Best Management Practices Handbook, December 2005.

Construction Site Best Management Practices Handbook, June 2008 Update, Truckee Meadows Regional Stormwater Quality Management Program, June 2008.

Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices, Texas Commission on Environmental Quality, Revised July 2005, Addendum Sheet, January 26, 2011.

Stormwater Management Manual for Western Washington Volume II, Construction Stormwater Pollution Prevention, Washington State Department of Ecology, February 2005.



## Description and Purpose

Compost socks and berms act as three-dimensional biodegradable filtering structures to intercept runoff where sheet flow occurs and are generally placed at the site perimeter or at intervals on sloped areas. Compost socks are generally a mesh sock containing compost and a compost berm is a dike of compost, trapezoidal in cross section. When employed to intercept sheet flow, both BMPs are placed perpendicular to the flow of runoff, allowing filtered runoff to pass through the compost and retaining sediment (and potentially other pollutants). A compost sock can be assembled on site by filling a mesh sock (e.g. with a pneumatic blower). The compost berm should be constructed using a backhoe or equivalent and/or a pneumatic delivery (blower) system and should be properly compacted. Compost socks and berms act as filters, reduce runoff velocities, and in some cases, aid in establishing vegetation.

Compost is organic, biodegradable, and renewable. Compost provides soil structure that allows water to infiltrate the compost medium which helps prevent rill erosion and the retained moisture promotes seed germination and vegetation growth, in addition to providing organic matter and nutrients important for fostering vegetation. Compost improves soil quality and productivity, as well as erosion and sediment control.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

- SE-1 Silt Fence
- SE-5 Fiber Roll
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-14 Biofilter Bags

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The compost of the compost sock or berm can be selected that targets site specific objectives in capturing sediment and other pollutants, supporting vegetation, or additional erosion control.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Green waste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly compost selection is an important design consideration in the application of this type of erosion and sediment control.

## Suitable Applications

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow (compost berms should only be used at the top of slopes or on slopes 4:1 (H:V) or flatter, all other slope applications should use compost socks)
- Along the perimeter of a project
- As check dams in unlined ditches (compost socks only)
- Down-slope of exposed soil areas
- At operational storm drains as a form of inlet protection (compost socks only)
- Around temporary stockpiles

Compost socks and berms do not require special trenching or BMP removal compared to other sediment control methods (e.g. silt fence or fiber rolls). Compost socks and berms can remain in place after earth disturbing activities are completed or the compost components can be spread over the site providing nutrients for plant growth and augmenting soil structure. BMPs that remain in place are particularly advantageous below embankments, especially adjacent streams, by limiting re-entry and the disturbance to sensitive areas.

Compost can be pre-seeded prior to application (recommended by the EPA for construction site stormwater runoff control and required for compost socks) or seeded after installation (for compost berms only). The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons.

## Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Compost should be obtained from a supplier certified by the California Integrated Waste Management Board or compost should otherwise meet the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7. Carefully consider the qualifications and experience of any compost producer/supplier.

- Application by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost-effective method of assembly.
- Compost socks and berms should not be employed at the base of slopes greater than 2:1 (H:V). They can be employed with other erosion control methods for steeper slopes.
- Difficult to move once saturated.
- Compost berms should not be applied in areas of concentrated flows.
- Compost socks and berms are easy to fix; however, they are susceptible to damage by frequent traffic. Compost socks can be used around heavy machinery, but regular disturbance decreases sock performance.

## Implementation

### Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in **Table 1**, taken from Caltrans *Standard Specifications* (2015).
- The Caltrans SSP, Section 21-2.02Q, *Compost Socks*, states that the sock used to retain the compost must be composed of natural, biodegradable products, such as cotton, jute, sisal, burlap or coir.
- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.
- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.
- Compost medium parameter specifications for compost socks and berms have been developed to assist in compost selection, such as those provided by the American Association of State Highway Transportation Officials (AASHTO).
- Particle size is important parameter for selecting compost. Well consolidated, coarser grades of compost (e.g., small and large pieces) perform better for filtration objectives, while finer grades better support vegetation. Particle size of the compost should be selected based on site conditions, such as expected precipitation, and filtration goals and / or long-term plant nutrients.
- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet

season, drier composts can be used as the compost will absorb moisture from the ambient air.

- If vegetation establishment is a desired function of the compost, a compost sample should be inspected by a qualified individual. Vegetation has different nutrient and moisture needs.
- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.
- Compost should not be derived from mixed municipal solid waste and should be reasonably free of visible contaminants.
- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.
- Compost should not possess objectionable odors.
- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost  
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	TMECC 04.11-A	6.0–8.5
Soluble Salts	TMECC 04.10-A	0–10.0
Moisture Content	TMECC 03.09-A	30–60
Organic Matter Content	TMECC 05.07-A	30–100
Maturity	TMECC 05.05-A	80 or Above 80 or Above
Stability	TMECC 05.08-B	8 or below
Particle size for fine compost: dry weight Pass 5/8-inch sieve (min, %) Pass 3/8-inch sieve (min, %)	TMECC 02.02-B	95 70
Particle size for medium compost: dry weight Pass 2-inch sieve (min, %) Pass 1-inch sieve (max, %)	TMECC 02.02-B	95 30
Particle size for coarse compost: dry weight Pass 2-1/2-inch sieve (min, %) Pass 3/8-inch sieve (max, %)	TMECC 02.02-B	99 40
Pathogen Fecal Coliform Bacteria MPN/1-gram dry wt.	TMECC 07.01-B	< 1,000
Pathogen Salmonella MPN/4 grams dry wt.	TMECC 07.01-B	< 3
Physical Contaminants (% dry weight) Plastics, glass, and metal	TMECC 02.02-C	Combined Total: < 1.0
Physical Contaminants (% dry weight) Sharps	TMECC 02.02-C	None Detected

\*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

## Installation

- Prior to application, prepare locations for socks and berms by removing brush and thick vegetation. The compost of the sock and/or berm should be allowed to come in full contact with the ground surface.
- Select method to apply the compost sock or berm. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.
- The compost of the berm should be distributed evenly to the surface, compacted, and shaped trapezoidal in cross section. Berm design is generally consisting of a base two times the height. AASHTO specification MP 9-03 provides compost berm dimensions based on anticipated site precipitation (AASHTO, 2003 and USEPA, 2009). State agencies, such as Oregon Department of Environmental Quality (ODEQ) have developed berm dimension based on slope steepness and length (ODEQ, 2004).

- Compost socks can be assembled on site by filling mesh socks with the selected compost. Mesh socks can be tied at one end, filled, and then tied at the other end. The ends of socks can be interlocked until the desired length is achieved. The sock diameter is a function of slope steepness and length. Again, ASSHTO provides specifications for various parameters. Compost socks range from 8" to 18" but are typically 12" to 18" in diameter.
- Compost socks are typically placed in contours perpendicular to sheet flow. They can also be placed in V formation on a slope. Compost socks need to be anchored, typically stakes, through the center of the sock. To prevent water flowing around them, the ends of compost socks should be placed upslope.
- Locate compost socks and berms on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Socks and/or berms should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Socks should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Socks should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Place perimeter socks and berms using a j-hook installation. Use of vegetation will also provide additional anchoring.
- Compost socks and berms can be placed around the perimeter of an affected area, like a silt fence, if the area is flat or on a contour. Do not place these socks and berms where ponded water could become an issue.
- If used at the toe of slopes, the compost sock or berm should at a minimum of 5 to 10 feet away.
- Use additional anchoring and erosion control BMPs in conjunction of the compost socks and berms as needed.
- Consider using compost berms or socks as necessary at the top and/or bottom of the slope for additional erosion control performance.
- Compost socks and berms can also be effective over rocky and frozen ground if installed properly.
- It is recommended that the drainage areas of these compost BMPs do not exceed 0.25 acre per 100 feet placement interval and runoff does not exceed 1 cubic foot per second.

## Costs

Recently obtained vendor costs indicated \$4.50 per linear foot for compost berm application and \$2.50 per linear foot for 8" socks and \$3.20 per linear foot for 12" socks (Adjusted for inflation, 2016 dollars, by Tetra Tech, Inc.). Costs do not include final compost sock or berm functions at the end of construction activities, including spreading or removal, if required. ODEQ estimates that compost berms cost 30 percent less than silt fences to install.

## Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Once damage is identified, mend or reapply the sock or berm as needed. Washed out areas should be replaced. If the sock or berm height is breached during a storm, an additional sock can be stacked to increase the sock height and similarly the berm dimensions can be increased, as applicable. An additional sock or berm may be installed upslope, as needed. It may be necessary to apply an additional type of stormwater BMP, such as a compost blanket.
- Sediment contained by the sock or berm should be removed prior reaching 1/3 of the exposed height of the BMP. The sediment can be stabilized with the compost sock or berm with vegetation at the end of construction activities.
- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Limit traffic to minimize damage to BMPs or impede vegetation establishment.

## References

An analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, [pubs.caes.uga.edu/caespubs/pubcd/B1200.htm](http://pubs.caes.uga.edu/caespubs/pubcd/B1200.htm), Faucette, B. and Risse, M., 2001.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

*Standard Specifications, State of California, California State Transportation Agency, Department of Transportation (Caltrans), 2015. Available online at:* [http://www.dot.ca.gov/hq/esc/oe/construction\\_contract\\_standards/std\\_specs/2015\\_StdSpecs/2015\\_StdSpecs.pdf](http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2015_StdSpecs/2015_StdSpecs.pdf).



Evaluation of Environmental Benefits and Impacts of Compost and Industry Standard Erosion and Sediment Controls Measures Used in Construction Activities, Dissertation, Institute of Ecology, University of Georgia, Faucette, B., 2004.

National Pollutant Discharge Elimination System (NPDES), Compost Blankets, U.S. Environmental Protection Agency (USEPA).

[http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=118](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118), 2009.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Designation MP-9, Compost for Erosion/Sediment Control (Filter Berms), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

Stormwater Best Management Practices (BMPs) Field Trials of Erosion Control Compost in Reclamation of Rock Quarry Operations, Nonpoint Source Protection Program CWA §319(h), Texas Commission on Environmental Quality, Adams, T., McFarland, A., Hauck, L., Barrett, M., and Eck, B., 2008.



## Description and Purpose

Biofilter bags, or bio-bags, are a multi-purpose sediment control BMP consisting of a plastic mesh bag filled with 100% recycled wood product waste. Biofilter bags come in a variety of sizes (30" x 18" and 30" x 9" being common) and generally have between 1-2 cubic yards of recycled wood waste (or wood chips). Biofilter bags work by detaining flow and allowing a slow rate of discharge through the wood media. This action removes suspended sediment through gravity settling of the detained water and filtration within the bag.

## Suitable Applications

Biofilter bags are a short-term BMP that can be rapidly deployed, maintained, and replaced. Biofilter bags can be an effective short-term solution to place in developed rills to prevent further erosion until permanent measures can be established. Suitable short-term applications include:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - Below other small cleared areas
  - Along the perimeter of a site (with low-expected flow)
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

- SE-1 Silt Fence
- SE-4 Check Dams
- SE-5 Fiber Roll
- SE-6 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-10 Storm Drain Inlet Protection

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- Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
  - At the top of slopes to divert runoff away from disturbed slopes
  - As check dams across mildly sloped construction roads
- Inlet Protection (See SE-10)
- Supplement to silt fences or other sediment control devices

## Limitations

- Short life-span (maximum usefulness of 2-3 months and should be replaced more frequently if needed); regular maintenance and replacement required to ensure effectiveness. Bags will rapidly fill with sediment and reduce permeability.
- Easily damaged by construction vehicles.
- If not properly staked, will fail on slope applications.
- If improperly installed can allow undercutting or side-cutting flow.
- Not effective where water velocities or volumes are high.
- Potentially buoyant and easily displaced if not properly installed.

## Implementation

### General

Biofilter bags are a relatively low cost temporary BMP that are easily deployed and have a simple installation that can be performed by hand. Without proper installation, however, biofilter bags can fail due to their light weight, potential displacement, and multiple joint locations. One of the benefits of utilizing biofilter bags is that the media (wood-product) can be recycled or used onsite when no longer needed (where acceptable).

### Design and Layout – Linear control

- Locate biofilter bags on level contours.
  - Slopes between 20:1 and 4:1 (H:V): Biofilter bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slopes between 4:1 and 2:1 (H:V): Biofilter bags should be placed at a maximum interval of 15 ft, with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Biofilter bags should be placed at a maximum interval of 10 ft., with the first row placed the slope toe.

- Turn the ends of the biofilter bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the biofilter bag berm to allow ponding, and to provide room for sediment storage.
- Stake biofilter bags into a 1 to 2 in. deep trench with a width equal to the bag.
  - Drive one stake at each end of the bag.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- Biofilter bags should be overlapped (6 in.), not abutted.

## Costs

Pre-filled biofilter bags cost approximately \$3.20-\$4.50 per bag, dependent upon size (Adjusted for inflation, 2016 dollars, by Tetra Tech, Inc.).

## Inspection and Maintenance

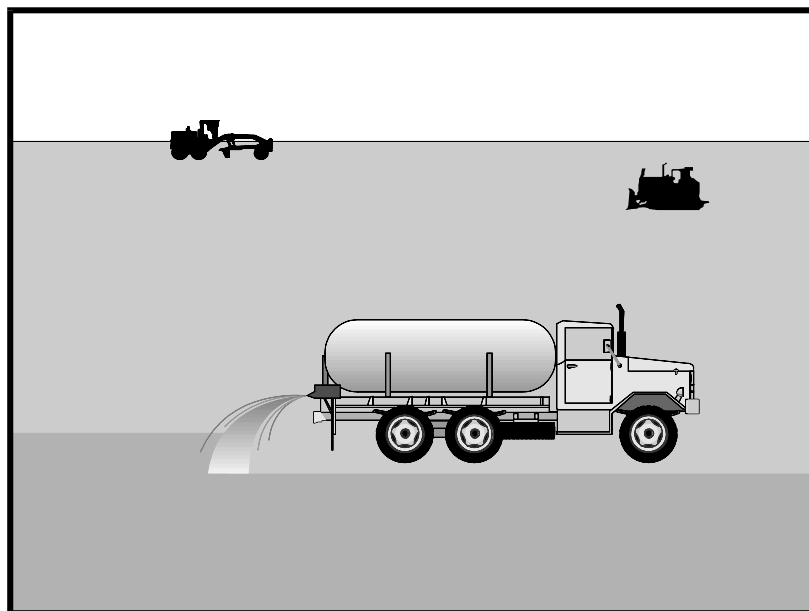
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Biofilter bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace biofilter bags as needed.
- Repair washouts or other damage as needed.
- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove biofilter bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Biofilter media may be used on-site, if allowed.

## References

Catalog of Stormwater Best Management Practices for Idaho Cities and Counties. Volume 2, Section 7, BMP 34 – Biofilter Bags, Idaho Department of Environmental Quality, 2005.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.



## Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking, and dust generated by construction equipment. Site conditions and climate can make dust control more of an erosion problem than water-based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

## Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	<input checked="" type="checkbox"/>
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Category
- ☒ Secondary Category

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

EC-5 Soil Binders

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- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

## Limitations

- Watering prevents dust only for a short period (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

## Implementation

### *Dust Control Practices*

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyl, acrylic), clay additives (e.g. bentonite, montmorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X			X
Disturbed Areas Subject to Traffic			X	X	X	X		X
Material Stockpiles		X	X	X			X	X
Demolition			X			X	X	
Clearing/Excavation			X	X				X
Truck Traffic on Unpaved Roads			X	X	X	X	X	
Tracking					X	X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet California Department of Health Services water reclamation criteria and the Regional Water Quality

Control Board (RWQCB) requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."

- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater and should meet all applicable regulatory requirements.

## Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of these measures are effective for only a few hours to a few days.

## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

## References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

California Air Pollution Control Laws, California Air Resources Board, updated annually.

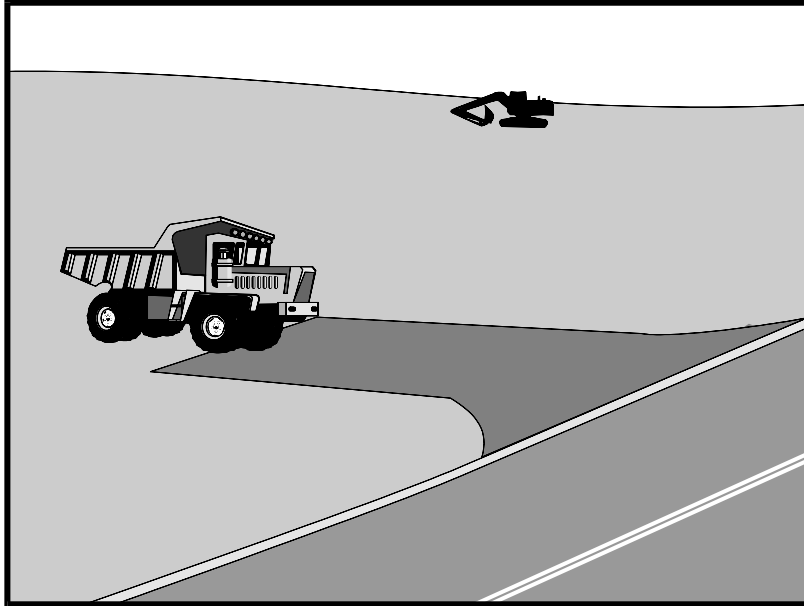
Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.



Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM<sub>10</sub>), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

# Stabilized Construction Entrance/Exit TC-1



## Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

## Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

## Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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# Stabilized Construction Entrance/Exit TC-1

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## Implementation

### *General*

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

### *Design and Layout*

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft or maximum site will allow, and 10 ft minimum width or to accommodate traffic.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.

# **Stabilized Construction Entrance/Exit TC-1**

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- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

## **Costs**

Average annual cost for installation and maintenance may vary from \$1,500 to \$6,100 each, averaging \$3,100 per entrance. Costs will increase with addition of washing rack and sediment trap. With wash rack, costs range from \$1,500 - \$7,700 each, averaging \$4,600 per entrance (All costs adjusted for inflation, 2016 dollars, by Tetra Tech Inc.

## **References**

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

# **Stabilized Construction Entrance/Exit TC-1**

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

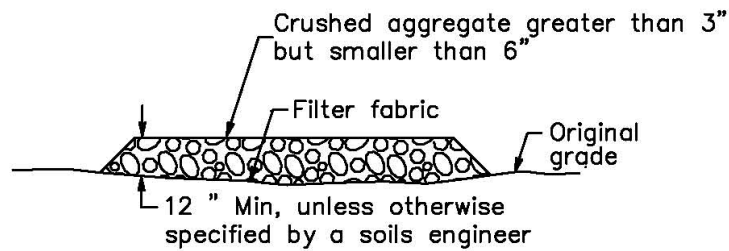
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

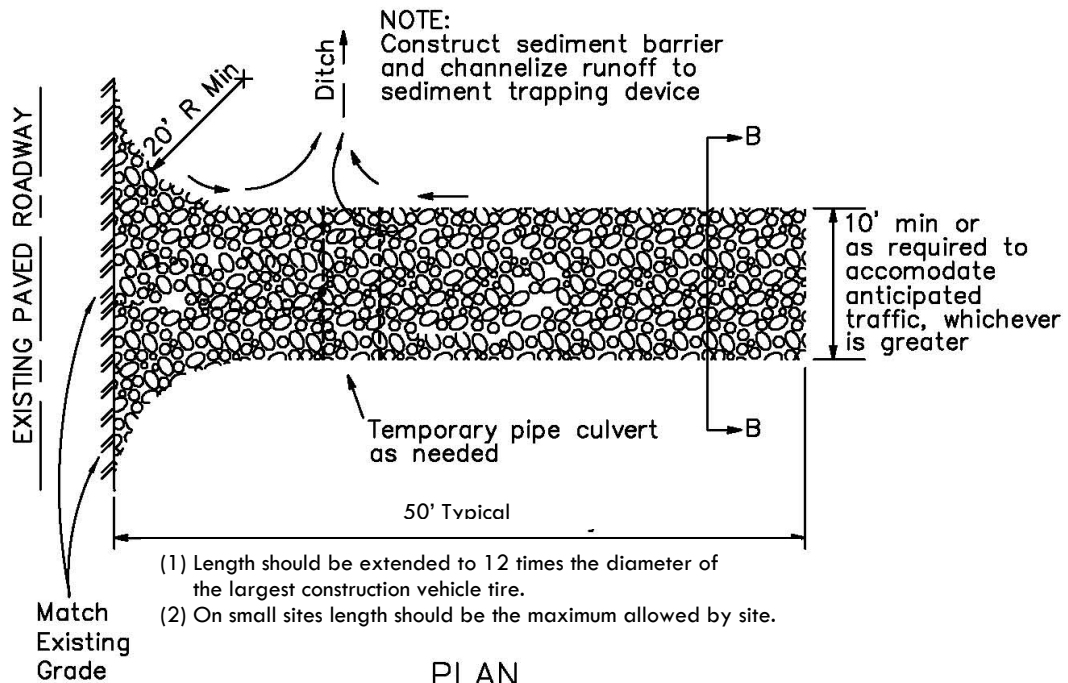
Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

# Stabilized Construction Entrance/Exit TC-1

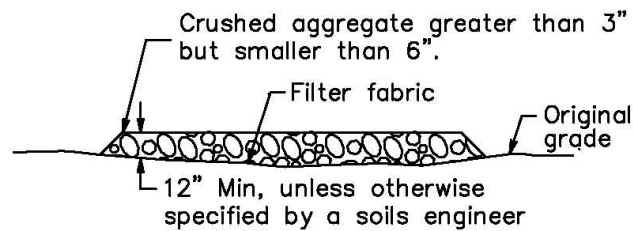


SECTION B-B  
NTS

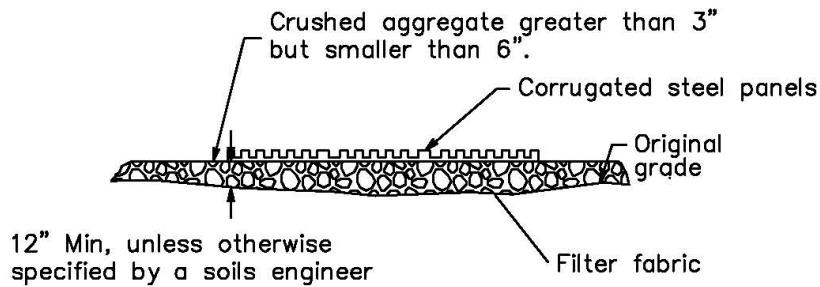


PLAN  
NTS

# Stabilized Construction Entrance/Exit TC-1

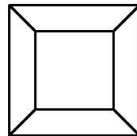


SECTION B-B  
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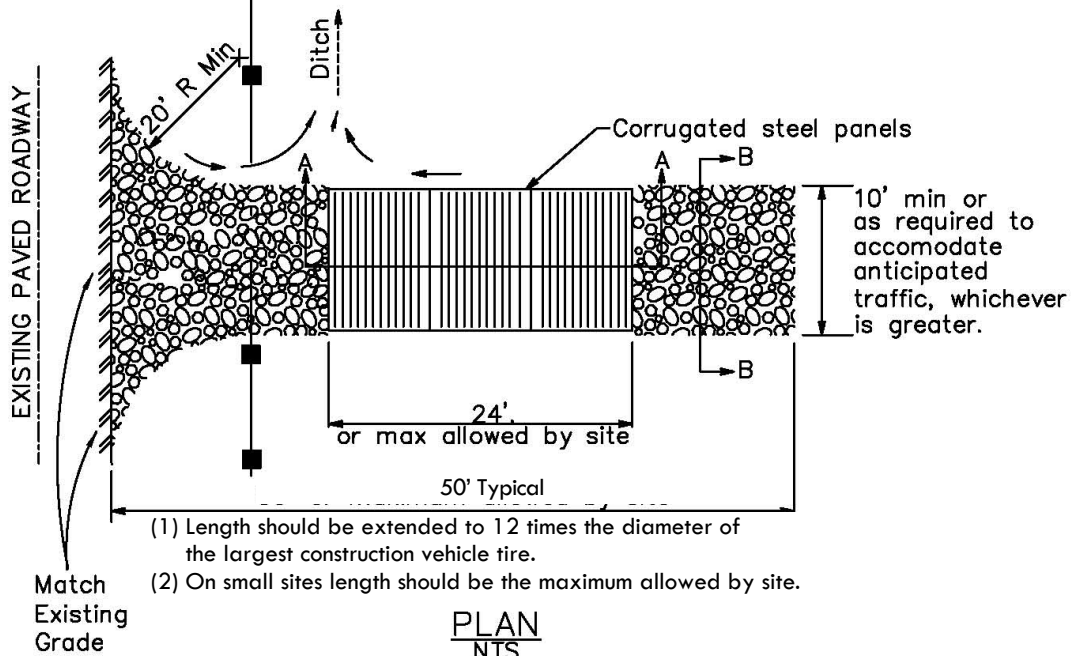


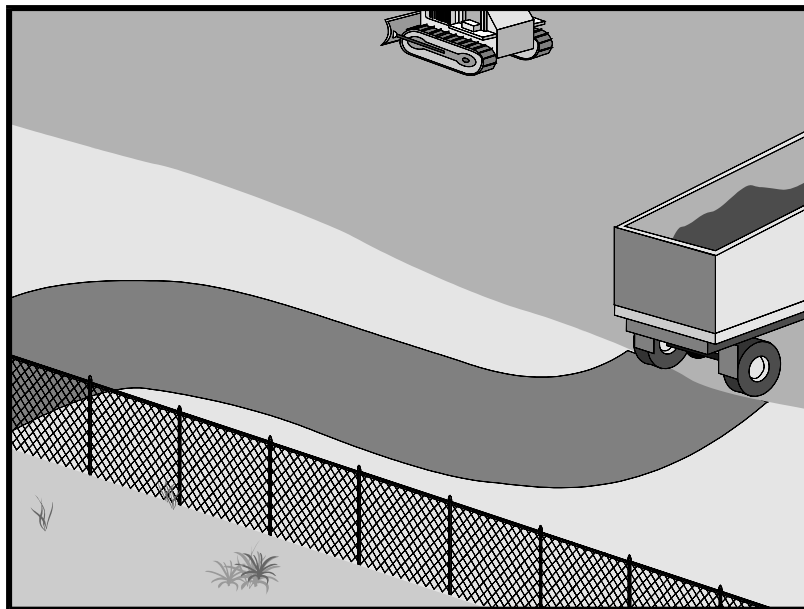
SECTION A-A  
NOT TO SCALE

NOTE:  
Construct sediment barrier and channelize runoff to sediment trapping device



Sediment trapping device





## Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

## Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and detour roads:
  - Where mud tracking is a problem during wet weather
  - Where dust is a problem during dry weather
  - Adjacent to water bodies
  - Where poor soils are encountered

## Limitations

- The roadway must be removed or paved when construction is complete.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

## Implementation

### *General*

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

### *Installation/Application Criteria*

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.

- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.
- Coordinate materials with those used for stabilized construction entrance/exit points.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.
- Periodically apply additional aggregate on gravel roads.
- Active dirt construction roads are commonly watered three or more times per day during the dry season.

## Costs

Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay. No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

## References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

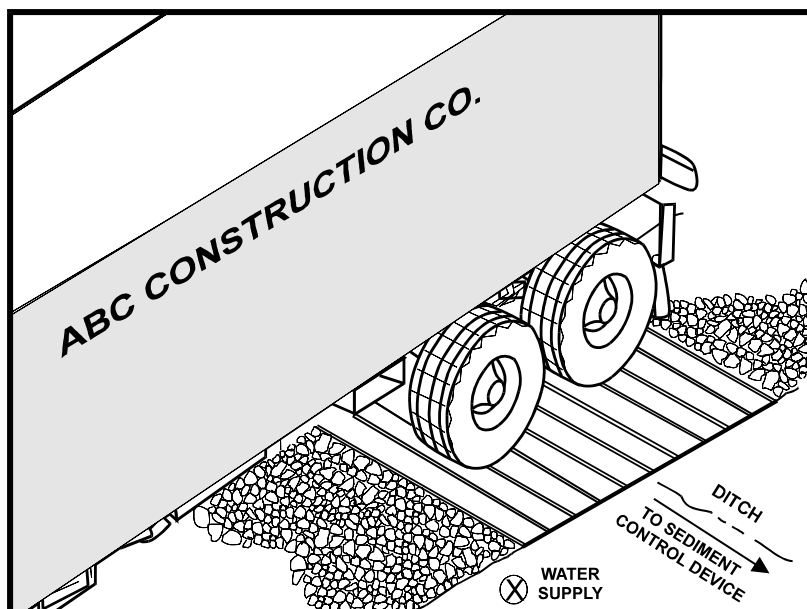
# **Stabilized Construction Roadway**

**TC-2**

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Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.



## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

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## Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and undercarriages and to prevent sediment from being transported onto public roadways.

## Suitable Applications

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

## Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

## Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.



- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

## Costs

Costs are low for installation of wash rack.

## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

## References

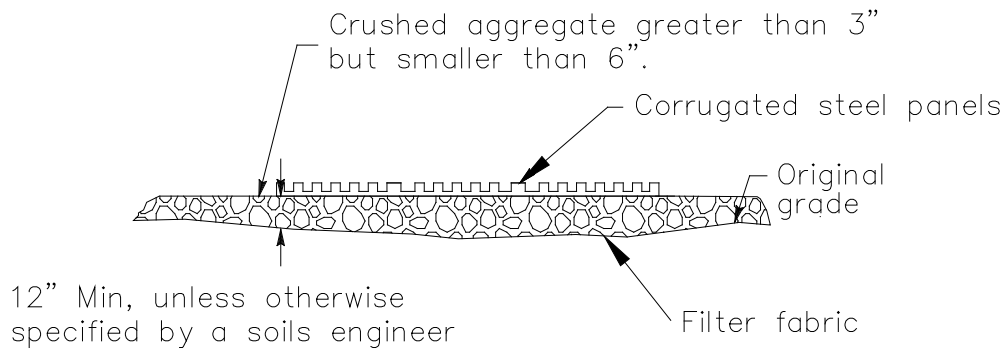
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

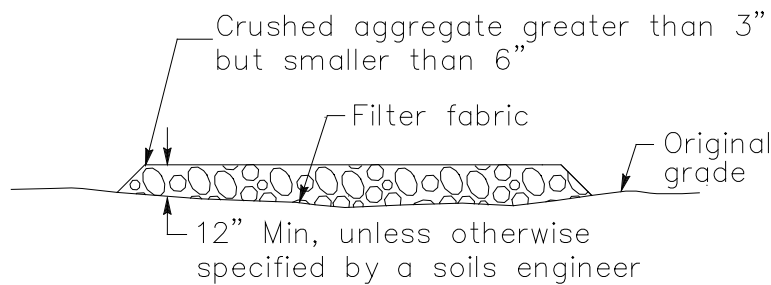
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

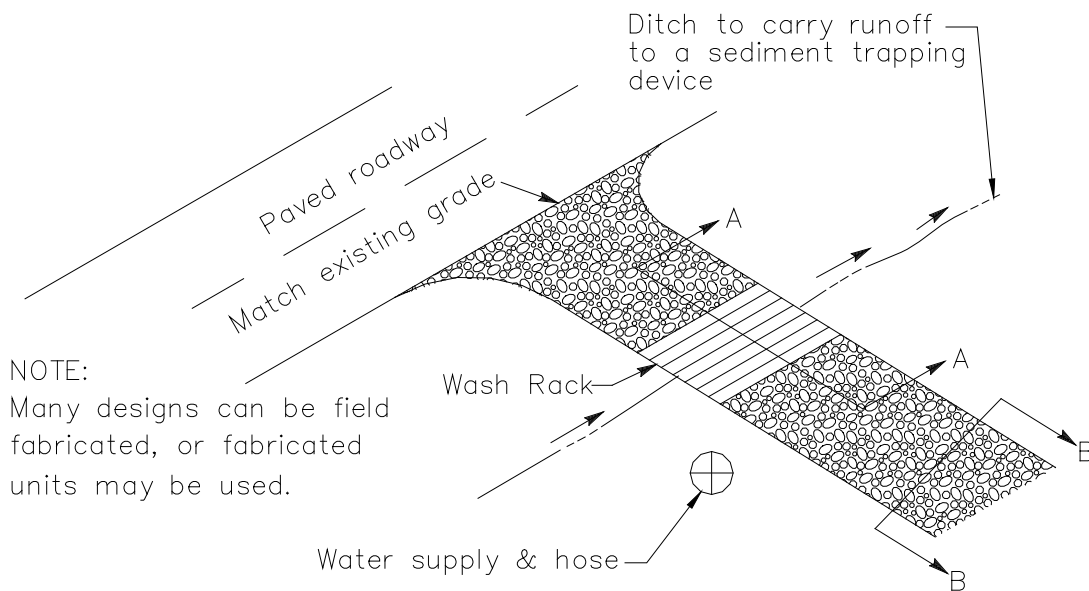
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A-A  
NOT TO SCALE



SECTION B-B  
NTS



TYPICAL TIRE WASH  
NOT TO SCALE

## Section 4

# Non-Stormwater Management and Material Management BMPs

## 4.1 Non-Stormwater Management BMPs

The [discharge](#) of materials other than [stormwater](#) and authorized [non-stormwater discharges](#) is prohibited by NPDES regulations as well as other local codes and ordinances. It is recognized that certain authorized non-stormwater discharges may be necessary for the completion of construction projects. Such discharges include, but are not limited to, irrigation of vegetative [erosion control](#) measures, and pipe flushing and testing.

Non-stormwater management [BMPs](#) are [source control BMPs](#) that prevent pollution by limiting or reducing potential [pollutants](#) at their source or eliminating off-site discharge. These practices involve day-to-day operations of the construction site and are usually under the control of the contractor. These BMPs are also referred to as “good housekeeping practices,” which involve keeping a clean, orderly construction site.

Non-stormwater management BMPs also include procedures and practices designed to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning, fueling, and maintenance operations to stormwater drainage systems or to watercourses.

Table 4-1 of this handbook lists the non-stormwater management BMPs. All these BMPs must be implemented depending on the conditions and applicability of deployment described as part of the BMP. The key to implementing these BMPs is to maintain a clean site and keep water, runoff, and run-on away from potential pollutants, including bare soil. In general, conduct construction activities so that: potential pollutants are not discharged directly to drainage systems; generation of potential pollutants is limited; and pollutants that are generated are contained and cleaned up immediately and are therefore not available for later discharge. These BMPs are fundamental to water quality protection and all sites must implement non-stormwater BMPs appropriate for the construction activities being performed.

**Table 4-1 Non-Stormwater Management BMPs**

BMP#	BMP Name
NS-1	Water Conservation Practices <sup>2</sup>
NS-2	Dewatering Operations <sup>1, 3</sup>
NS-3	Paving and Grinding Operations <sup>1, 3</sup>
NS-4	Temporary Stream Crossing <sup>1, 2</sup>
NS-5	Clear Water Diversion <sup>2</sup>
NS-6	Illicit Connection/Discharge <sup>1, 2</sup>
NS-7	Potable Water/Irrigation <sup>1, 2</sup>
NS-8	Vehicle and Equipment Cleaning <sup>1, 2</sup>
NS-9	Vehicle and Equipment Fueling <sup>1, 2</sup>
NS-10	Vehicle and Equipment Maintenance <sup>1, 2</sup>
NS-11	Pile Driving Operations <sup>1, 2</sup>
NS-12	Concrete Curing <sup>1, 3</sup>
NS-13	Concrete Finishing <sup>1, 3</sup>
NS-14	Material Over Water <sup>1, 2</sup>
NS-15	Demolition Adjacent to Water <sup>1, 2</sup>
NS-16	Temporary Batch Plants <sup>1, 3</sup>
1) BMP fact sheet updated in 2009	
2) BMP fact sheet updated in 2011	
3) BMP fact sheet updated in 2012	

It is recommended that owners and contractors be vigilant regarding implementation of these BMPs, including making their implementation a condition of continued employment, and part of all prime and subcontract agreements. By doing so, the chance of inadvertent violation by an uncaring individual can be prevented, potentially saving thousands of dollars in fines and project delays. Also, if procedures are not properly implemented and/or if BMPs are compromised then the discharge may be subject to additional sampling and analysis requirements for non-visible pollutants contained in the [General Permit](#). (See Section 2.5.4.2. of this handbook)

## 4.2 Waste Management and Materials Pollution Control BMPs

[Waste management](#) and materials pollution control BMPs, like non-stormwater management BMPs, are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with stormwater. These BMPs also involve day-to-day operations of the construction site, and are under the control of the contractor, and are additional “good housekeeping practices,” which involve keeping a clean, orderly construction site. These BMPs are fundamental to water quality protection and all sites must implement waste management and/or materials pollution control non-stormwater BMPs appropriate for the construction activities being performed.

Waste management consists of implementing procedural and structural BMPs for handling, storing, and disposing of wastes generated by a construction project to prevent the release of waste materials into stormwater runoff or discharges through proper management of the following types of wastes:

- Solid
- Sanitary
- Concrete
- Hazardous
- Equipment-related wastes

Materials pollution control (also called materials handling) consists of implementing procedural and structural BMPs in the handling of, storing, and the using of construction materials. The BMPs are intended to prevent the release of pollutants during stormwater and non-stormwater

**Table 4-2 Waste Management and Materials Pollution Control BMPs**

BMP#	BMP Name
WM-1	Material Delivery and Storage <sup>1</sup>
WM-2	Material Use <sup>1</sup>
WM-3	Stockpile Management <sup>1, 2, 3</sup>
WM-4	Spill Prevention and Control <sup>1, 2</sup>
WM-5	Solid Waste Management <sup>1, 2</sup>
WM-6	Hazardous Waste Management <sup>1, 2</sup>
WM-7	Contaminated Soil Management <sup>1, 2</sup>
WM-8	Concrete Waste Management <sup>1, 3</sup>
WM-9	Sanitary/ Septic Waste Management <sup>1</sup>
WM-10	Liquid Waste Management <sup>1</sup>
<sup>1</sup> ) BMP fact sheet updated in 2009 <sup>2</sup> ) BMP fact sheet updated in 2011 <sup>3</sup> ) BMP fact sheet updated in 2012	



discharges. The objective is to prevent or reduce the opportunity for contamination of stormwater runoff from construction materials by covering and/or providing [secondary containment](#) of storage areas and/or by taking adequate precautions when handling materials. These controls must be implemented for all applicable activities, material usage, and site conditions. The discharge of construction materials or wastes from a site is prohibited.

**Table 4-2** of this handbook lists the waste management and materials pollution control BMPs. It is important to note that these BMPs should be implemented depending on the conditions/applicability of deployment described as part of the BMP.

### 4.3 Fact Sheet Format

A BMP fact sheet is a short document that presents detailed information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 4-1 of this handbook. Completed fact sheets for each of the above activities are provided in Section 4.4 of this handbook.

The fact sheets also contain side bar presentations with information on BMP categories, targeted constituents, removal effectiveness, and potential alternatives.

#### Example NS-xx Fact Sheet

Description and Purpose

Suitable Applications

Limitations

Implementation

Costs

Inspection and Maintenance

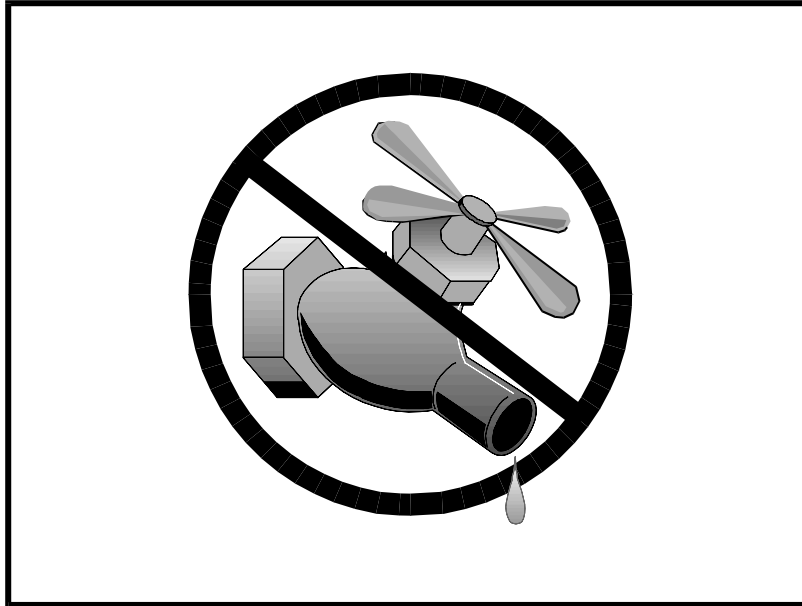
References

*Figure 4-1  
Example Fact Sheet*

### 4.4 BMP Fact Sheets

BMP fact sheets for non-stormwater management and waste management and materials pollution control follow. The BMP fact sheets are individually page numbered and are suitable for inclusions in SWPPPs. Copies of the fact sheets can be individually downloaded from the CASQA Online BMP Handbook at <http://www.casqa.org>.

BMP fact sheets are guidance and intended to provide a range of information about the BMPs. The BMP fact sheets should not be interpreted as General Permit requirements. CASQA recognizes that there may be alternative public domain and/or proprietary practices performing similar function. Alternative products should be evaluated for project-specific implementation and used if determined to be appropriate by the QSD. Fact sheets do not address site-specific implementation application needs and modifications. The QSD should provide site specific implementation requirements in the SWPPP.



## Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

## Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

## Limitations

- None identified.

## Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Direct construction water runoff to areas where it can soak into the ground or be collected and used.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

## **Costs**

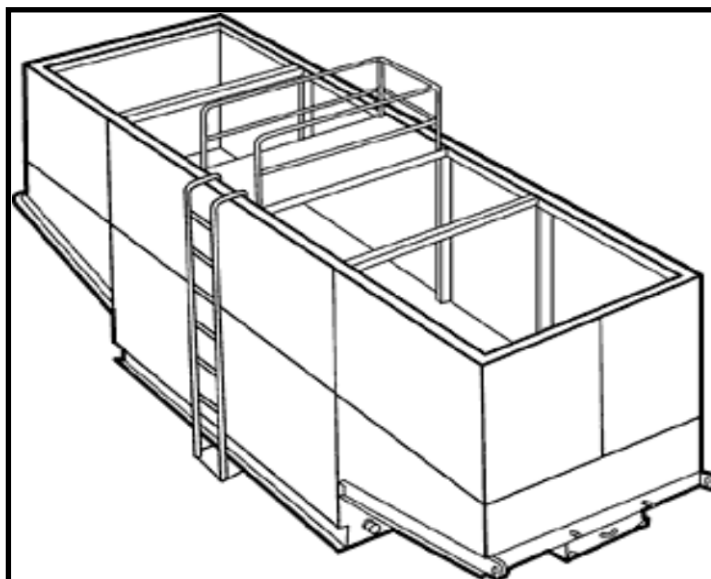
The cost is small to none compared to the benefits of conserving water.

## **Inspection and Maintenance**

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occurring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

## **References**

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



## Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.

The General Permit incorporates Numeric Action Levels (NAL) for turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Discharges from dewatering operations can contain high levels of fine sediment that, if not properly treated, could lead to exceedances of the General Permit requirements or Basin Plan standards.

The dewatering operations described in this fact sheet are not Active Treatment Systems (ATS) and do not include the use of chemical coagulations, chemical flocculation or electrocoagulation.

## Suitable Applications

These practices are implemented for discharges of non-stormwater from construction sites. Non-stormwaters include, but are not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area to facilitate construction.

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated

## Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

- SE-5: Fiber Roll
- SE-6: Gravel Bag Berm

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precipitation (stormwater) from depressed areas at a construction site.

Stormwater mixed with non-stormwater should be managed as non-stormwater.

## Limitations

- Dewatering operations will require and should comply with applicable local and project-specific permits and regulations. In some areas, all dewatering activities, regardless of the discharge volume, require a dewatering permit.
- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this fact sheet primarily address sediment. Other secondary pollutant removal benefits are discussed where applicable.
- The controls detailed in this fact sheet only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Avoid dewatering discharges where possible by using the water for dust control.

## Implementation

- A Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP).
- Regional Water Quality Control Board (RWQCB) Regions may require notification and approval prior to any discharge of water from construction sites.
- The destination of discharge from dewatering activities will typically determine the type of permit required for the discharge. For example, when discharging to a water of the U.S., a dewatering permit may be required through the site's governing RWQCB. When discharging to a sanitary sewer or Municipal Separate Storm Sewer System (MS4), a permit may need to be obtained from the owner of the sanitary sewer or MS4 in addition to obtaining an RWQCB dewatering permit. Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges should not cause erosion at the discharge point. Appropriate BMPs should be implemented to maintain compliance with all applicable permits.
- Maintain dewatering records in accordance with all local and project-specific permits and regulations.

## Sediment Treatment

A variety of methods can be used to treat water during dewatering operations. Several devices are presented below and provide options to achieve sediment removal. The sediment particle size and permit or receiving water limitations on sediment or turbidity are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate. Use of other enhanced treatment methods (i.e., introduction of chemicals or electric current to enhance flocculation and removal of sediment) must comply with: 1) for storm drain or surface water discharges, the requirements for Active Treatment Systems (see SE-11); or 2) for sanitary sewer discharges, the requirements of applicable sanitary sewer discharge permits.

## ***Sediment Basin (see also SE-2)***

### *Description:*

- A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment basins are generally larger than Sediment Traps (SE-3) and have a designed outlet structure.

### *Appropriate Applications:*

- Effective for the removal of trash, gravel, sand, silt, some metals that settle out with the sediment.

### *Implementation:*

- Excavation and construction of related facilities is required.
- Temporary sediment basins should be fenced if safety is a concern.
- Outlet protection is required to prevent erosion at the outfall location.

### *Maintenance:*

- Maintenance is required for safety fencing, vegetation, embankment, inlet and outlet, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

## ***Sediment Trap (See also SE-3)***

### *Description:*

- A sediment trap is a temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment traps are generally smaller than Sediment Basins (SE-2) and do not have a designed outlet (but do have a spillway or overflow).

### *Appropriate Applications:*

Effective for the removal of large and medium sized particles (sand and gravel) and some metals that settle out with the sediment.

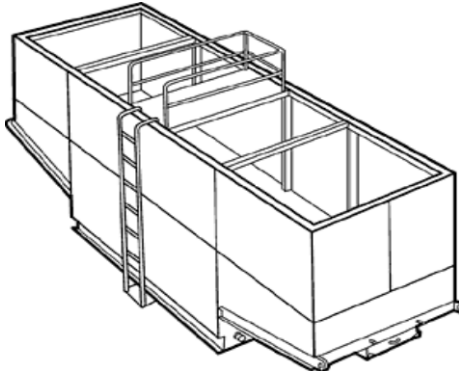
### *Implementation:*

- Excavation and construction of related facilities is required.
- Trap inlets should be located to maximize the travel distance to the trap outlet.
- Use rock or vegetation to protect the trap outlets against erosion.

### *Maintenance:*

- Maintenance is required for vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

## *Weir Tanks*



### *Description:*

- A weir tank separates water and waste by using weirs. The configuration of the weirs (over and under weirs) maximizes the residence time in the tank and determines the waste to be removed from the water, such as oil, grease, and sediments.

### *Appropriate Applications:*

- The tank removes trash, some settleable solids (gravel, sand, and silt), some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

### *Implementation:*

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.
- Treatment capacity (i.e., volume and number of tanks) should provide at a minimum the required volume for discrete particle settling for treatment design flows.

### *Maintenance:*

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal should be conducted by a licensed waste disposal company.

## *Dewatering Tanks*



### *Description:*

- A dewatering tank removes debris and sediment. Flow enters the tank through the top, passes through a fabric filter, and is discharged through the bottom of the tank. The filter separates the solids from the liquids.

### *Appropriate Applications:*

- The tank removes trash, gravel, sand, and silt, some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

### *Implementation:*

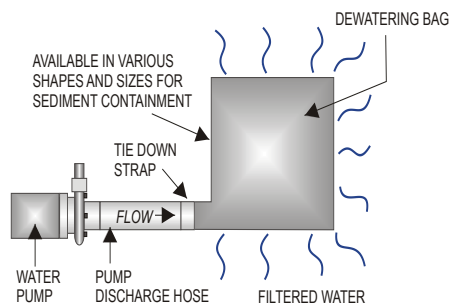
- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

### *Maintenance:*

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal should be conducted by licensed waste disposal company.



## *Gravity Bag Filter*



### *Description:*

- A gravity bag filter, also referred to as a dewatering bag, is a square or rectangular bag made of non-woven geotextile fabric that collects gravel, sand, silt, and fines.

### *Appropriate Applications:*

- Effective for the removal of sediments (gravel, sand, silt, and fines). Some metals are removed with the sediment.

### *Implementation:*

- Water is pumped into one side of the bag and seeps through the top, bottom, and sides of the bag.
- Place filter bag on pavement or a gravel bed or paved surface. Avoid placing a dewatering bag on unprotected bare soil. If placing the bag on bare soil is unavoidable, a secondary barrier should be used, such as a rock filter bed placed beneath and beyond the edges of the bag to, prevent erosion and capture sediments that escape the bag.
- Perimeter control around the downstream end of the bag should be implemented. Secondary sediment controls are important especially in the initial stages of discharge, which tend to allow fines to pass through the bag.

### *Maintenance:*

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier (as applicable) is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- Caution should be taken when removing and disposing of the bag, to prevent the release of captured sediment
- Properly dispose of the bag offsite. If sediment is removed from the bag prior to disposal (bags can potentially be reused depending upon their condition), dispose of sediment in accordance with the general maintenance procedures described at the end of this BMP Fact Sheet.

## *Sand Media Particulate Filter*



### *Description:*

- Water is treated by passing it through canisters filled with sand media. Generally, sand filters provide a final level of treatment. They are often used as a secondary or higher level of treatment after a significant amount of sediment and other pollutants have been removed using other methods.

### *Appropriate Applications:*

- Effective for the removal of trash, gravel, sand, and silt and some metals, as well as the reduction of biochemical oxygen demand (BOD) and turbidity.
- Sand filters can be used for stand-alone treatment or in conjunction with bag and cartridge filtration if further treatment is required.
- Sand filters can also be used to provide additional treatment to water treated via settling or basic filtration.

### *Implementation:*

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

### *Maintenance:*

- The filters require regular service to monitor and maintain the level of the sand media. If subjected to high loading rates, filters can plug quickly.
- Venders generally provide data on maximum head loss through the filter. The filter should be monitored daily while in use and cleaned when head loss reaches target levels.
- If cleaned by backwashing, the backwash water may need to be hauled away for disposal or returned to the upper end of the treatment train for another pass through the series of dewatering BMPs.

## *Pressurized Bag Filter*



### *Description:*

- A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header. Vendors provide bag filters in a variety of configurations. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

### *Appropriate Applications:*

- Effective for the removal of sediment (sand and silt) and some metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Oil absorbent bags are available for hydrocarbon removal.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

### *Implementation:*

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

### *Maintenance:*

- The filter bags require replacement when the pressure differential equals or exceeds the manufacturer's recommendation.

## *Cartridge Filter*



### *Description:*

- Cartridge filters provide a high degree of pollutant removal by utilizing a number of individual cartridges as part of a larger filtering unit. They are often used as a secondary or higher (polishing) level of treatment after a significant amount of sediment and other pollutants are removed. Units come with various cartridge configurations (for use in series with bag filters) or with a larger single cartridge filtration unit (with multiple filters within).

### *Appropriate Applications:*

- Effective for the removal of sediment (sand, silt, and some clays) and metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Hydrocarbons can effectively be removed with special resin cartridges.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

### *Implementation:*

- The filters require delivery to the site and initial set up. The vendor can provide assistance.

### *Maintenance:*

- The cartridges require replacement when the pressure differential equals or exceeds the manufacturer's recommendation.

## **Costs**

- Sediment control costs vary considerably depending on the dewatering and sediment treatment system that is selected. Pressurized filters tend to be more expensive than gravity settling but are often more effective. Simple tanks are generally rented on a long-term basis (one or more months) and can range from \$460 per month for a 1,000-gallon tank to \$3,400 per month for a 10,000-gallon tank (adjusted for inflation, 2016 dollars, by Tetra Tech Inc.). Mobilization and demobilization costs vary considerably.

## **Inspection and Maintenance**

- Inspect and verify that dewatering BMPs are in place and functioning prior to the commencement of activities requiring dewatering.
- Inspect dewatering BMPs daily while dewatering activities are being conducted.

- Inspect all equipment before use. Monitor dewatering operations to ensure they do not cause offsite discharge or erosion.
- Sample dewatering discharges as required by the General Permit.
- Unit-specific maintenance requirements are included with the description of each unit.
- Sediment removed during the maintenance of a dewatering device may be either spread onsite and stabilized or disposed of at a disposal site as approved by the owner.
- Sediment that is commingled with other pollutants should be disposed of in accordance with all applicable laws and regulations and as approved by the owner.

## References

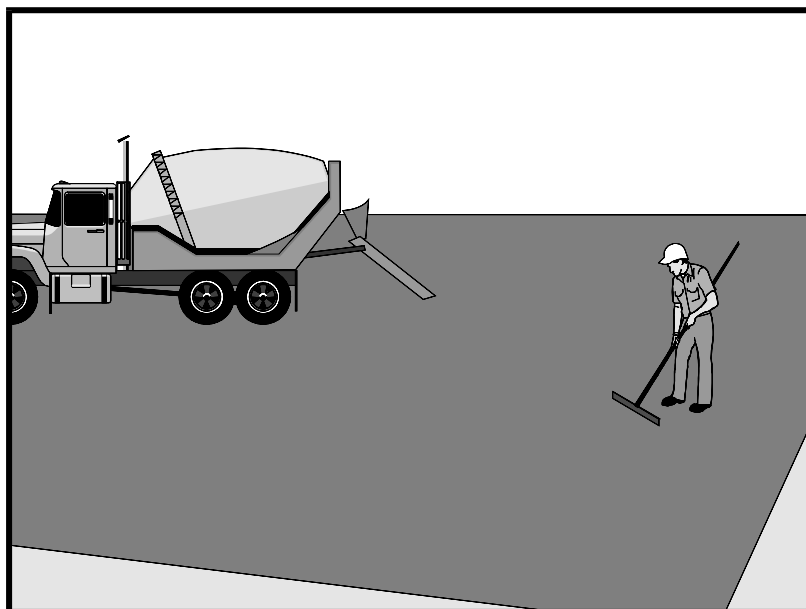
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003; Updated March 2004.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Labor Surcharge & Equipment Rental Rates, April 1, 2002 through March 31, 2003, California Department of Transportation (Caltrans).

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



## Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runoff and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

The General Permit incorporates Numeric Action Levels (NAL) for pH and turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials associated with paving and grinding operations, including mortar, concrete, and cement and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

## Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

## Limitations

- Paving opportunities may be limited during wet weather.

Discharges of freshly paved surfaces may raise pH to environmentally harmful levels and trigger permit violations.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None

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## Implementation

### *General*

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is forecasted.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runoff (see WM-1, Material Delivery and Storage).
- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC (Portland cement concrete) and AC (asphalt concrete) waste should be in conformance with WM-8, Concrete Waste Management.

### *Saw Cutting, Grinding, and Pavement Removal*

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing should not be allowed to enter any storm drains or watercourses. Install inlet protection and perimeter controls until area is stabilized (i.e. cutting, grinding or other removal activities are complete and loose material has been properly removed and disposed of) or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; SE-5, Fiber Rolls, or SE-13 Compost Socks and Berms
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt should be recycled or disposed of properly.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by a vacuum attachment to the grinding machine, or by sweeping, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Pavement removal activities should not be conducted in the rain.
- Collect removed pavement material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.

- If removed pavement material cannot be recycled, transport the material back to an approved storage site.

## ***Asphaltic Concrete Paving***

- If paving involves asphaltic cement concrete, follow these steps:
  - Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.
  - Old asphalt should be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

## ***Portland Cement Concrete Paving***

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect waste materials by dry methods, such as sweeping or shoveling, and return to aggregate base stockpile or dispose of properly. Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if authorized by the local wastewater authority.

## ***Sealing Operations***

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate should not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized (i.e. all sealing operations are complete and cured and loose materials have been properly removed and disposed).
- Inlet protection (SE-10, Storm Drain Inlet Protection) should be used during application of seal coat, tack coat, slurry seal, and fog seal.
- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

## ***Paving Equipment***

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials and dispose of in accordance with the applicable regulations. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.
- Substances used to coat asphalt transport trucks and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.
- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.
- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.



## ***Thermoplastic Striping***

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

## ***Raised/Recessed Pavement Marker Application and Removal***

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

## **Costs**

- All of the above are low cost measures.

## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of paving and grinding operations.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sample stormwater runoff required by the General Permit.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

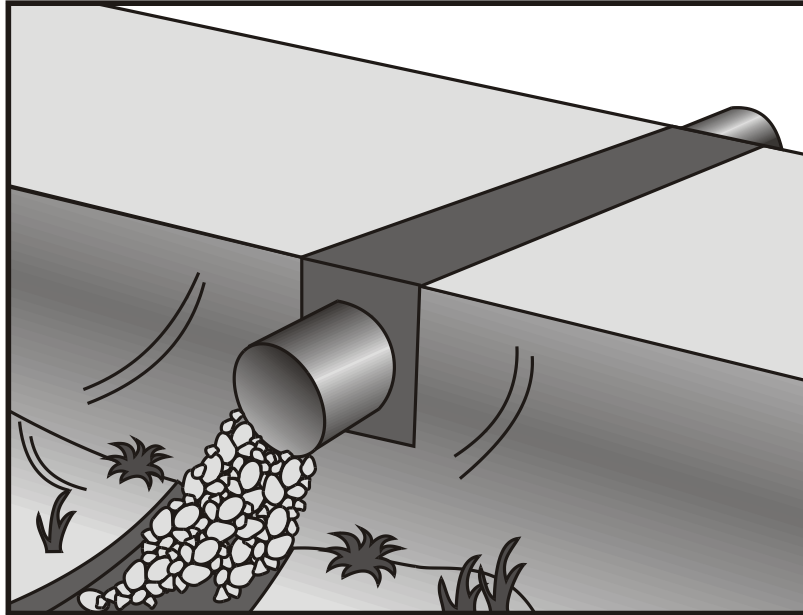
## **References**

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Hot Mix Asphalt-Paving Handbook AC 150/5370-14, Appendix I, U.S. Army Corps of Engineers, July 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



## Description and Purpose

A temporary stream crossing is a temporary culvert, ford or bridge placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not intended to maintain traffic for the public. The temporary access will eliminate erosion and downstream sedimentation caused by vehicles.

## Suitable Applications

Temporary stream crossings should be installed at all designated crossings of perennial and intermittent streams on the construction site, as well as for dry channels that may be significantly eroded by construction traffic.

Temporary stream crossings are installed at sites:

- Where appropriate permits have been secured (404 Permits, and 401 Certifications)
- Where construction equipment or vehicles need to frequently cross a waterway
- When alternate access routes impose significant constraints
- When crossing perennial streams or waterways causes significant erosion
- Where construction activities will not last longer than one year

## Categories

EC	Erosion Control	<input checked="" type="checkbox"/>
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	<input checked="" type="checkbox"/>
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Where appropriate permits have been obtained for the stream crossing

## Limitations

The following limitations may apply:

- Installation and removal will usually disturb the waterway.
- Installation may require Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game. If numerical-based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required.
- Installation may require dewatering or temporary diversion of the stream. See NS-2, Dewatering Operations and NS-5, Clear Water Diversion.
- Installation may cause a constriction in the waterway, which can obstruct flood flow and cause flow backups or washouts. If improperly designed, flow backups can increase the pollutant load through washouts and scouring.
- Use of natural or other gravel in the stream for construction of Cellular Confinement System (CCS) ford crossing will be contingent upon approval by fisheries agencies.
- Ford crossings may degrade water quality due to contact with vehicles and equipment.
- May be expensive for a temporary improvement.
- Requires other BMPs to minimize soil disturbance during installation and removal.
- Fords should only be used in dry weather.

## Implementation

### General

The purpose of this BMP is to provide a safe, erosion-free access across a stream for construction equipment. Minimum standards and specifications for the design, construction, maintenance, and removal of the structure should be established by an engineer registered in California. Temporary stream crossings may be necessary to prevent construction equipment from causing erosion of the stream and tracking sediment and other pollutants into the stream.

Temporary stream crossings are used as access points to construction sites when other detour routes may be too long or burdensome for the construction equipment. Often heavy construction equipment must cross streams or creeks, and detour routes may impose too many constraints such as being too narrow or poor soil strength for the equipment loadings. Additionally, the contractor may find a temporary stream crossing more economical for light-duty vehicles to use for frequent crossings and may have less environmental impact than construction of a temporary access road.

Location of the temporary stream crossing should address:

- Site selection where erosion potential is low.

- Areas where the side slopes from site runoff will not spill into the side slopes of the crossing.

The following types of temporary stream crossings should be considered:

- **Culverts** – A temporary culvert is effective in controlling erosion but will cause erosion during installation and removal. A temporary culvert can be easily constructed and allows for heavy equipment loads.
- **Fords** - Appropriate during the dry season in arid areas. Used on dry washes and ephemeral streams, and low-flow perennial streams. CCS, a type of ford crossing, is also appropriate for use in streams that would benefit from an influx of gravels. A temporary ford provides little sediment and erosion control and is ineffective in controlling erosion in the stream channel. A temporary ford is the least expensive stream crossing and allows for maximum load limits. It also offers very low maintenance. Fords are more appropriate during the dry ice season and in arid areas of California.
- **Bridges** - Appropriate for streams with high flow velocities, steep gradients and where temporary restrictions in the channel are not allowed.

## ***Design***

During the long summer construction season in much of California, rainfall is infrequent, and many streams are dry. Under these conditions, a temporary ford may be sufficient. A ford is not appropriate if construction will continue through the winter rainy season, if summer thunderstorms are likely, or if the stream flows during most of the year. Temporary culverts and bridges should then be considered and, if used, should be sized to pass a significant design storm (i.e., at least a 10-year storm). The temporary stream crossing should be protected against erosion, both to prevent excessive sedimentation in the stream and to prevent washout of the crossing.

Design and installation requires knowledge of stream flows and soil strength. Designs should be prepared under direction of, and approved by, a registered civil engineer and for bridges, a registered structural engineer. Both hydraulic and construction loading requirements should be considered with the following:

- Comply with any special requirements for culvert and bridge crossings, particularly if the temporary stream crossing will remain through the rainy season.
- Provide stability in the crossing and adjacent areas to withstand the design flow. The design flow and safety factor should be selected based on careful evaluation of the risks due to over topping, flow backups, or washout.
- Install sediment traps immediately downstream of crossings to capture sediments. See SE-3, Sediment Trap.
- Avoid oil or other potentially hazardous materials for surface treatment.
- Culverts are relatively easy to construct and able to support heavy equipment loads.
- Fords are the least expensive of the crossings, with maximum load limits.

- CCS crossing structures consist of clean, washed gravel and cellular confinement system blocks. CCS are appropriate for streams that would benefit from an influx of gravel; for example, salmonid streams, streams or rivers below reservoirs, and urban, channelized streams. Many urban stream systems are gravel-deprived due to human influences, such as dams, gravel mines, and concrete channels.
- CCS allow designers to use either angular or naturally occurring rounded gravel, because the cells provide the necessary structure and stability. In fact, natural gravel is optimal for this technique, because of the habitat improvement it will provide after removal of the CCS.
- A gravel depth of 6 to 12 in. for a CCS structure is sufficient to support most construction equipment.
- An advantage of a CCS crossing structure is that relatively little rock or gravel is needed, because the CCS provides the stability.
- Bridges are generally more expensive to design and construct but provide the least disturbance of the streambed and constriction of the waterway flows.

## ***Construction and Use***

- Stabilize construction roadways, adjacent work area, and stream bottom against erosion.
- Construct during dry periods to minimize stream disturbance and reduce costs.
- Construct at or near the natural elevation of the streambed to prevent potential flooding upstream of the crossing.
- Install temporary erosion control BMPs in accordance with erosion control BMP fact sheets to minimize erosion of embankment into flow lines.
- Any temporary artificial obstruction placed within flowing water should only be built from material, such as clean gravel or sandbags, that will not introduce sediment or silt into the watercourse.
- Temporary water body crossings and encroachments should be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments should be clean, rounded river cobble.
- Vehicles and equipment should not be driven, operated, fueled, cleaned, maintained, or stored in the wet or dry portions of a water body where wetland vegetation, riparian vegetation, or aquatic organisms may be destroyed.
- The exterior of vehicles and equipment that will encroach on the water body within the project should be maintained free of grease, oil, fuel, and residues.
- Drip pans should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.

- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate soil stabilization measures.
- Riparian vegetation, when removed pursuant to the provisions of the work, should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble must be removed upon completion of project activities.
- Conceptual temporary stream crossings are shown in the attached figures.

## Costs

Caltrans Construction Cost index for temporary bridge crossings is \$58-\$122/ft<sup>2</sup> (costs adjusted for inflation, 2016 dollars, by Tetra Tech Inc.).

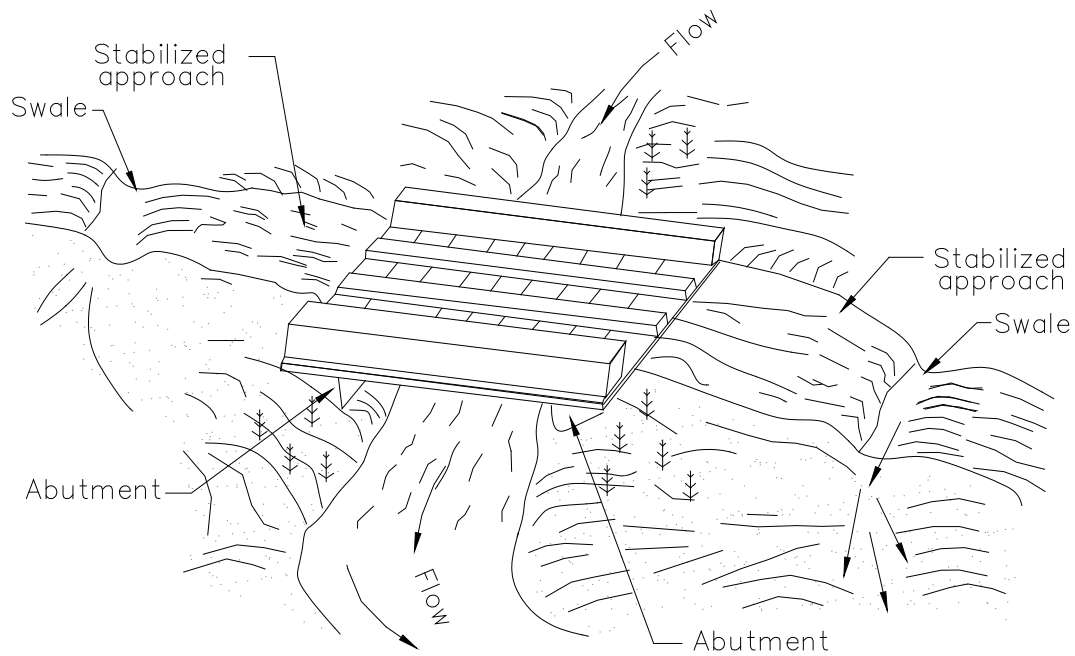
## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check for blockage in the channel, sediment buildup or trapped debris in culverts, blockage behind fords or under bridges.
- Check for erosion of abutments, channel scour, riprap displacement, or piping in the soil.
- Check for structural weakening of the temporary crossings, such as cracks, and undermining of foundations and abutments.
- Remove sediment that collects behind fords, in culverts, and under bridges periodically.
- Replace lost or displaced aggregate from inlets and outlets of culverts and cellular confinement systems.
- Remove temporary crossing promptly when it is no longer needed.

## References

California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TLo3, October 2000.

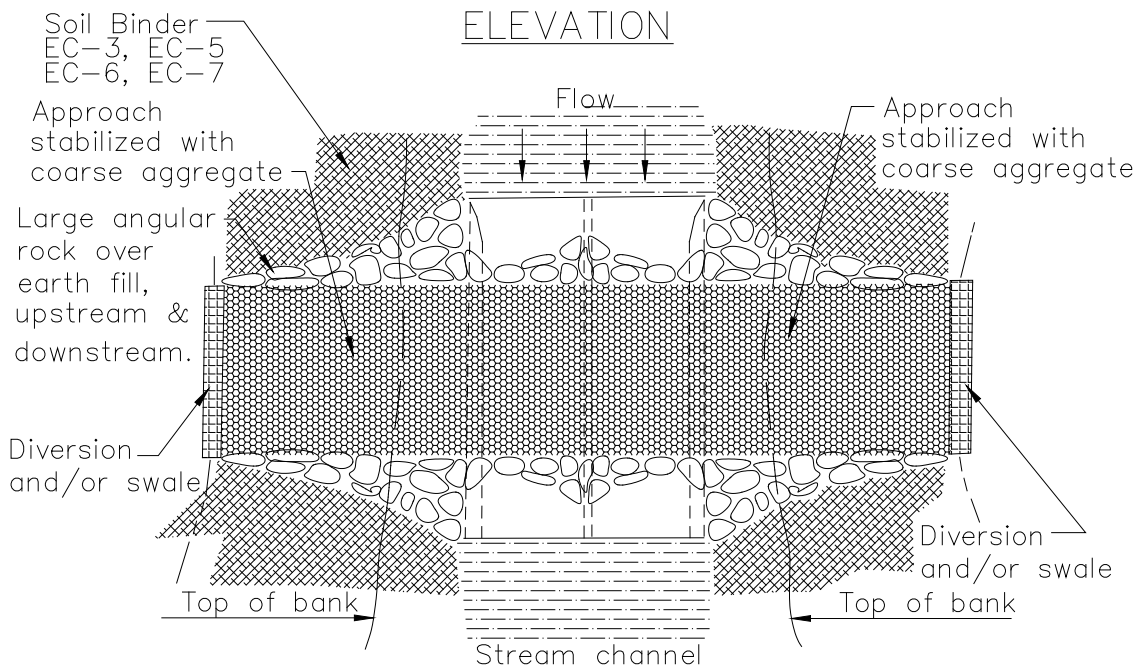
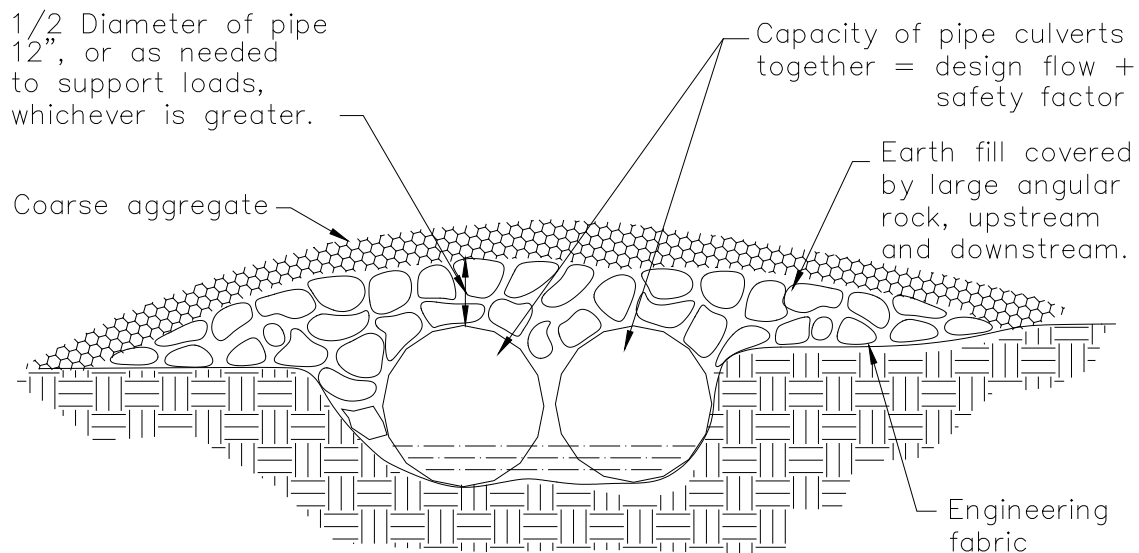
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



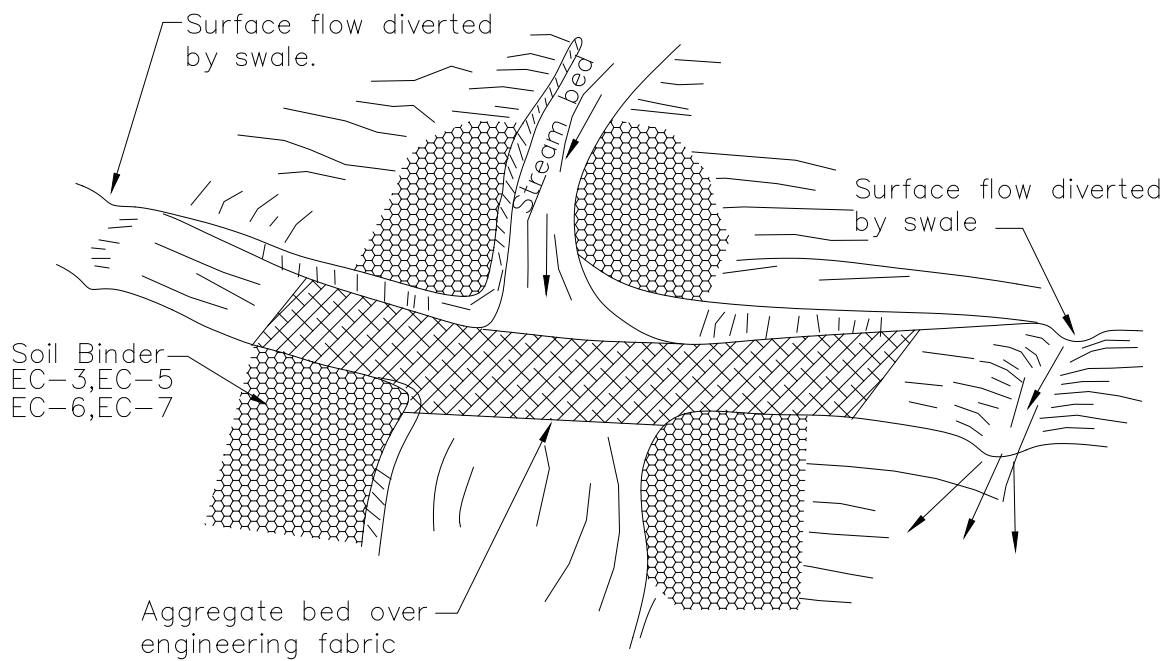
NOTE:  
Surface flow of road diverted  
by swale and/or dike.

TYPICAL BRIDGE CROSSING  
NOT TO SCALE

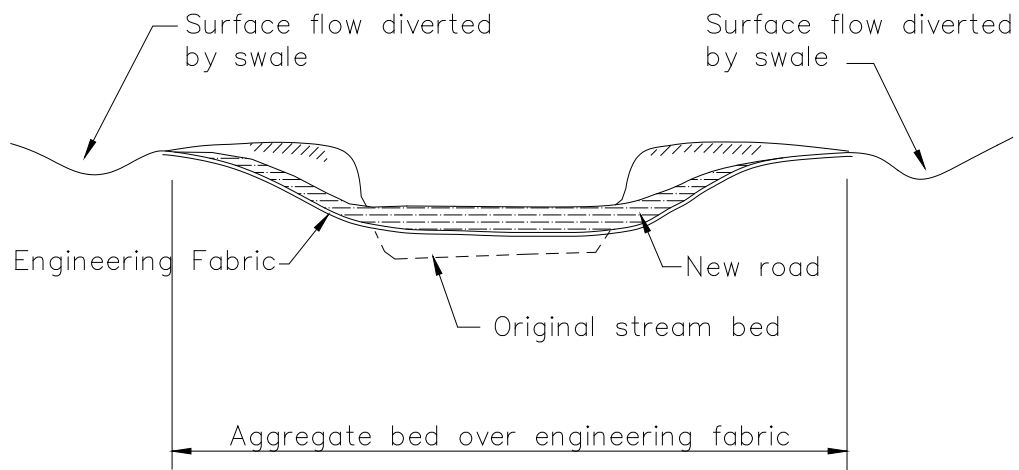




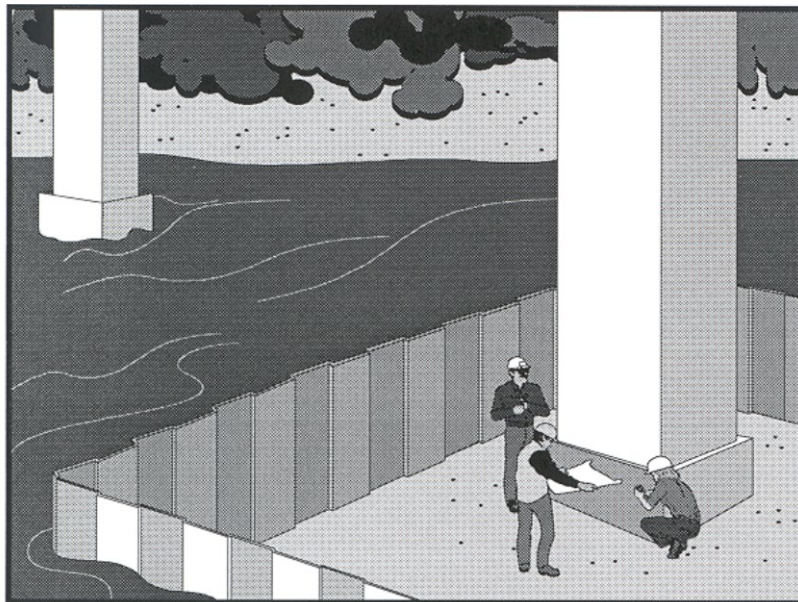
TYPICAL CULVERT CROSSING  
NOT TO SCALE



Aggregate approach  
1:5 (V:H) Maximum slope on road



TYPICAL FORD CROSSING  
NOT TO SCALE



## Description and Purpose

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a project, transport it around the work area, and discharge it downstream with minimal water quality degradation from either the project construction operations or the construction of the diversion. Clear water diversions are used in a waterway to enclose a construction area and reduce sediment pollution from construction work occurring in or adjacent to water. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, rock, gravel bags, wood, aqua barriers, cofferdams, filter fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes.

## Suitable Applications

A clear water diversion is typically implemented where appropriate permits (1601 Agreement) have been secured and work must be performed in a flowing stream or water body.

- Clear water diversions are appropriate for isolating construction activities occurring within or near a water body such as streambank stabilization, or culvert, bridge, pier or abutment installation. They may also be used in combination with other methods, such as clear water bypasses and/or pumps.
- Pumped diversions are suitable for intermittent and low flow streams.
- Excavation of a temporary bypass channel or passing the flow through a heavy pipe (called a “flume”) with a trench

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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excavated under it, is appropriate for the diversion of streams less than 20 ft wide, with flow rates less than 100 cfs.

- Clear water diversions incorporating clean washed gravel may be appropriate for use in salmonid spawning streams.

## Limitations

- Diversion and encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
- Installation may require Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game. If numerical-based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required.
- Diversion and encroachment activities may constrict the waterway, which can obstruct flood flows and cause flooding or washouts. Diversion structures should not be installed without identifying potential impacts to the stream channel.
- Diversion or isolation activities are not appropriate in channels where there is insufficient stream flow to support aquatic species in the area dewatered as a result of the diversion.
- Diversion or isolation activities are inappropriate in deep water unless designed or reviewed by an engineer registered in California.
- Diversion or isolation activities should not completely dam stream flow.
- Dewatering and removal may require additional sediment control or water treatment. See NS-2, Dewatering Operations.
- Not appropriate if installation, maintenance, and removal of the structures will disturb sensitive aquatic species of concern.

## Implementation

### General

- Implement guidelines presented in EC-12, Streambank Stabilization to minimize impacts to streambanks.
- Where working areas encroach on flowing streams, barriers adequate to prevent the flow of muddy water into streams should be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams should be held to a minimum.
- Diversion structures must be adequately designed to accommodate fluctuations in water depth or flow volume due to tides, storms, flash floods, etc.
- Heavy equipment driven in wet portions of a water body to accomplish work should be completely clean of petroleum residue, and water levels should be below the fuel tanks, gearboxes, and axles of the equipment unless lubricants and fuels are sealed such that inundation by water will not result in discharges of fuels, oils, greases, or hydraulic fluids.

- Excavation equipment buckets may reach out into the water for the purpose of removing or placing fill materials. Only the bucket of the crane/ excavator/backhoe may operate in a water body. The main body of the crane/excavator/backhoe should not enter the water body except as necessary to cross the stream to access the work site.
- Stationary equipment such as motors and pumps located within or adjacent to a water body, should be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water should, at all times, be allowed to pass downstream to maintain aquatic life.
- Equipment should not be parked below the high-water mark unless allowed by a permit.
- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate erosion control measures.
- Riparian vegetation approved for trimming as part of the project should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble should be removed upon completion of project activities.
- Drip pans should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- Where possible, avoid or minimize diversion and encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. Scheduling should also consider seasonal releases of water from dams, fish migration and spawning seasons, and water demands due to crop irrigation.
- Construct diversion structures with materials free of potential pollutants such as soil, silt, sand, clay, grease, or oil.

## ***Temporary Diversions and Encroachments***

- Construct diversion channels in accordance with EC-9, Earth Dikes and Drainage Swales.
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, in accordance with EC-7, Geotextiles and Mats, or use rock slope protection.
- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment and slope protection, or other temporary soil stabilization methods.
- Provide for velocity dissipation at transitions in the diversion, such as the point where the stream is diverted to the channel and the point where the diverted stream is returned to its natural channel. See also EC-10, Velocity Dissipation Devices.

## ***Temporary Dry Construction Areas***

- When dewatering behind temporary structures to create a temporary dry construction area, such as cofferdams, pass pumped water through a sediment-settling device, such as a portable tank or settling basin, before returning water to the water body. See also NS-2, Dewatering Operations.
- Any substance used to assemble or maintain diversion structures, such as form oil, should be non-toxic and non-hazardous.
- Any material used to minimize seepage underneath diversion structures, such as grout, should be non-toxic, non-hazardous, and as close to a neutral pH as possible.

## ***Comparison of Diversion and Isolation Techniques:***

- Gravel bags are relatively inexpensive, but installation and removal can be labor intensive. It is also difficult to dewater the isolated area. Sandbags should not be used for this technique in rivers or streams, as sand should never be put into or adjacent to a stream, even if encapsulated in geotextile.
- Gravel Bag Berms (SE-6) used in conjunction with an impermeable membrane are cost effective and can be dewatered relatively easily. If spawning gravel is used, the impermeable membrane can be removed from the stream, and the gravel can be spread out and left as salmonid spawning habitat if approved in the permit. Only clean, washed gravel should be used for both the gravel bag and gravel berm techniques.
- Cofferdams are relatively expensive, but frequently allow full dewatering. Also, many options now available are relatively easy to install.
- Sheet pile enclosures are a much more expensive solution but do allow full dewatering. This technique is not well suited to small streams, but can be effective on large rivers or lakes, and where staging and heavy equipment access areas are available.
- K-rails are an isolation method that does not allow full dewatering, but can be used in small to large watercourses, and in fast-water situations.
- A relatively inexpensive isolation method is filter fabric isolation. This method involves placement of gravel bags or continuous berms to 'key-in' the fabric, and subsequently staking the fabric in place. This method should be used in relatively calm water and can be used in smaller streams. Note that this is not a dewatering method, but rather a sediment isolation method.
- Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They can also be used for in-stream construction, when dewatering an area is not required.
- When used in watercourses or streams, cofferdams must be used in accordance with permit requirements.
- Manufactured diversion structures should be installed following manufacturer's specifications.

- Filter fabric and turbidity curtain isolation installation methods can be found in the specific technique descriptions that follow.

## ***Filter Fabric Isolation Technique***

### *Definition and Purpose*

A filter fabric isolation structure is a temporary structure built into a waterway to enclose a construction area and reduce sediment pollution from construction work in or adjacent to water. This structure is composed of filter fabric, gravel bags, and steel t-posts.

### *Appropriate Applications*

- Filter fabric may be used for construction activities such as streambank stabilization, or culvert, bridge, pier or abutment installation. It may also be used in combination with other methods, such as clean water bypasses and/or pumps.
- Filter fabric isolation is relatively inexpensive. This method involves placement of gravel bags or continuous berms to 'key-in' the fabric, and subsequently staking the fabric in place.
- If spawning gravel is used, all other components of the isolation can be removed from the stream, and the gravel may be spread out and left as salmonid spawning habitat if approved in the permit. Whether spawning gravel or other types of gravel are used, only clean washed gravel should be used as infill for the gravel bags or continuous berm.
- This method should be used in relatively calm water and can be used in smaller streams. This is not a dewatering method, but rather a sediment isolation method.
- Water levels inside and outside the fabric curtain must be about the same, as differential heads will cause the curtain to collapse.

### *Limitations*

- Do not use if the installation, maintenance and removal of the structures will disturb sensitive aquatic species of concern.
- Filter fabrics are not appropriate for projects where dewatering is necessary.
- Filter fabrics are not appropriate to completely dam stream flow.

### *Design and Installation*

- For the filter fabric isolation method, a non-woven or heavy-duty fabric is recommended over standard silt fence. Using rolled geotextiles allows non-standard widths to be used.
- Anchor filter fabric with gravel bags filled with clean, washed gravel. Do not use sand. If a bag should split open, the gravel can be left in the stream, where it can provide aquatic habitat benefits. If a sandbag splits open in a watercourse, the sand could cause a decrease in water quality, and could bury sensitive aquatic habitat.
- Another anchor alternative is a continuous berm, made with the Continuous Berm Machine. This is a gravel-filled bag that can be made in very long segments. The length of the berms is usually limited to 18 ft for ease of handling (otherwise, it gets too heavy to move).

- Place the fabric on the bottom of the stream, and place either a bag of clean, washed gravel or a continuous berm over the bottom of the silt fence fabric, such that a bag-width of fabric lies on the stream bottom. The bag should be placed on what will be the outside of the isolation area.
- Pull the fabric up and place a metal t-post immediately behind the fabric, on the inside of the isolation area; attach the silt fence to the post with three diagonal nylon ties.
- Continue placing fabric as described above until the entire work area has been isolated, staking the fabric at least every 6 ft.

## *Inspection and Maintenance*

- Immediately repair any gaps, holes or scour.
- Remove and properly dispose of sediment buildup.
- Remove BMP upon completion of construction activity. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

## ***Turbidity Curtain Isolation Technique***

### *Definition and Purpose*

A turbidity curtain is a fabric barrier used to isolate the near shore work area. The barriers are intended to confine the suspended sediment. The curtain is a floating barrier, and thus does not prevent water from entering the isolated area; rather, it prevents suspended sediment from getting out.

### *Appropriate Applications*

Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They are used when construction activities adjoin quiescent waters, such as lakes, ponds, and slow flowing rivers. The curtains are designed to deflect and contain sediment within a limited area and provide sufficient retention time so that the sediment particles will fall out of suspension.

### *Limitations*

- Turbidity curtains should not be used in flowing water; they are best suited for use in ponds, lakes, and very slow-moving rivers.
- Turbidity curtains should not be placed across the width of a channel.
- Removing sediment that has been deflected and settled out by the curtain may create a discharge problem through the resuspension of particles and by accidental dumping by the removal equipment.

### *Design and Installation*

- Turbidity curtains should be oriented parallel to the direction of flow.
- The curtain should extend the entire depth of the watercourse in calm-water situations.
- In wave conditions, the curtain should extend to within 1 ft of the bottom of the watercourse, such that the curtain does not stir up sediment by hitting the bottom repeatedly. If it is



desirable for the curtain to reach the bottom in an active-water situation, a pervious filter fabric may be used for the bottom 1 ft.

- The top of the curtain should consist of flexible flotation buoys, and the bottom should be held down by a load line incorporated into the curtain fabric. The fabric should be a brightly colored impervious mesh.
- The curtain should be held in place by anchors placed at least every 100 ft.
- First, place the anchors, then tow the fabric out in a furled condition, and connect to the anchors. The anchors should be connected to the flotation devices, and not to the bottom of the curtain. Once in place, cut the furling lines, and allow the bottom of the curtain to sink.
- Consideration must be given to the probable outcome of the removal procedure. It must be determined if it will create more of a sediment problem through re-suspension of the particles or by accidental dumping of material during removal. It is recommended that the soil particles trapped by the turbidity curtain only be removed if there has been a significant change in the original contours of the affected area in the watercourse.
- Particles should always be allowed to settle for a minimum of 6 to 12 hours prior to their removal or prior to removal of the turbidity curtain.

### *Maintenance and Inspection:*

- The curtain should be inspected for holes or other problems, and any repairs needed should be made promptly.
- Allow sediment to settle for 6 to 12 hours prior to removal of sediment or curtain. This means that after removing sediment, wait an additional 6 to 12 hours before removing the curtain.
- To remove, install furling lines along the curtain, detach from anchors, and tow out of the water.

## ***K-rail River Isolation***

### *Definition and Purpose*

This temporary sediment control or stream isolation method uses K-rails to form the sediment deposition area, or to isolate the in-stream or near-bank construction area.

Barriers are placed end-to-end in a pre-designed configuration and gravel-filled bags are used at the toe of the barrier and at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

### *Appropriate Applications*

The K-rail isolation can be used in streams with higher water velocities than many other isolation techniques.

- This technique is also useful at the toe of embankments and cut or fill slopes.

## *Limitations*

- The K-rail method should not be used to dewater a project site, as the barrier is not watertight.

## *Design and Installation*

- To create a floor for the K-rail, move large rocks and obstructions. Place washed gravel and gravel-filled bags to create a level surface for K-rails to sit. Washed gravel should always be used.
- Place the bottom two K-rails adjacent to each other, and parallel to the direction of flow; fill the center portion with gravel bags. Then place the third K-rail on top of the bottom two. There should be sufficient gravel bags between the bottom K-rails such that the top rail is supported by the gravel. Place plastic sheeting around the K-rails, and secure at the bottom with gravel bags.
- Further support can be added by pinning and cabling the K-rails together. Also, large riprap and boulders can be used to support either side of the K-rail, especially where there is strong current.

## *Inspection and Maintenance:*

- The barrier should be inspected, and any leaks, holes, or other problems should be addressed immediately.
- Sediment should be allowed to settle for at least 6 to 12 hours prior to removal of sediment, and for 6 to 12 hours prior to removal of the barrier.

## ***Stream Diversions***

The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

### *Advantages of a Pumped Diversion*

- Downstream sediment transport can be nearly eliminated.
- Dewatering of the work area is possible.
- Pipes can be moved around to allow construction operations.
- The dams can serve as temporary access to the site.
- Increased flows can be managed by adding more pumping capacity.

### *Disadvantages of a Pumped Diversion*

- Flow volume is limited by pump capacity.
- A pumped diversion requires 24-hour monitoring of pumps.
- Sudden rain could overtop dams.
- Erosion at the outlet.

- Minor in-stream disturbance is required to install and remove dams.

### *Advantages of Excavated Channels and Flumes*

- Excavated channels isolate work from water flow and allow dewatering.
- Excavated channels can handle larger flows than pumps.

### *Disadvantages of Excavated Channels and Flumes*

- Bypass channel or flume must be sized to handle flows, including possible floods.
- Channels must be protected from erosion.
- Flow diversion and re-direction with small dams involves in-stream disturbance and mobilization of sediment.

### *Design and Installation*

- Installation guidelines will vary based on existing site conditions and type of diversion used.
- Pump capacity must be sufficient for design flow.
- A standby pump is required in case a primary pump fails.
- Dam materials used to create dams upstream and downstream of diversion should be erosion resistant; materials such as steel plate, sheet pile, sandbags, continuous berms, inflatable water bladders, etc., would be acceptable.

When constructing a diversion channel, begin excavation of the channel at the proposed downstream end, and work upstream. Once the watercourse to be diverted is reached and the excavated channel is stable, breach the upstream end and allow water to flow down the new channel. Once flow has been established in the diversion channel, install the diversion weir in the main channel; this will force all water to be diverted from the main channel.

### *Inspection and Maintenance*

- Pumped diversions require 24-hour monitoring of pumps.
- Inspect embankments and diversion channels for damage to the linings, accumulating debris, sediment buildup, and adequacy of the slope protection. Remove debris and repair linings and slope protection as required. Remove holes, gaps, or scour.
- Upon completion of work, the diversion or isolation structure should be removed, and flow should be redirected through the new culvert or back into the original stream channel. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

## **Costs**

Costs of clear water diversion vary considerably and can be very high.

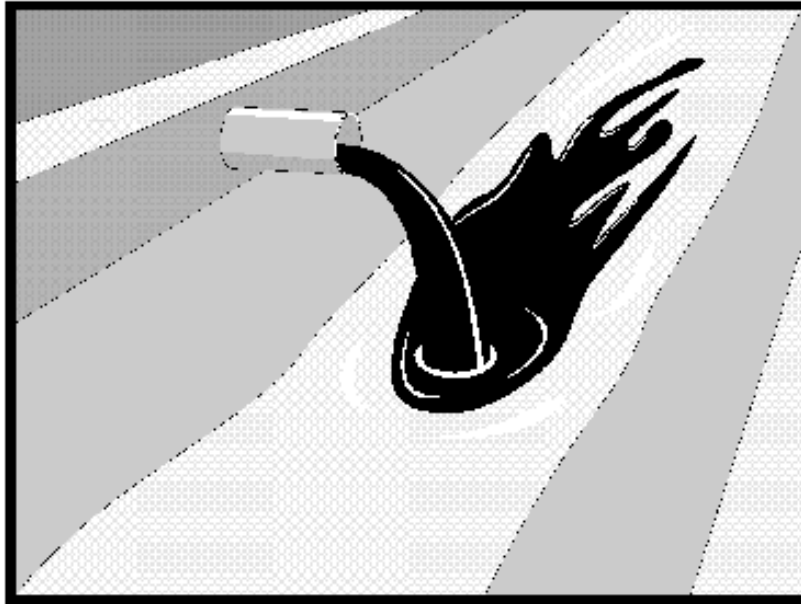
## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Refer to BMP-specific inspection and maintenance requirements.

## References

California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

## Description and Purpose

Procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.

## Suitable Applications

This best management practice (BMP) applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered, or illegally dumped material is found on the construction site.

## Limitations

Illicit connections and illegal discharges or dumping, for the purposes of this BMP, refer to discharges and dumping caused by parties other than the contractor. If pre-existing hazardous materials or wastes are known to exist onsite, they should be identified in the SWPPP and handled as set forth in the SWPPP.

## Implementation

### Planning

- Review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- Inspect site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions and notify the owner.

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- Inspect site regularly during project execution for evidence of illicit connections, illegal dumping or discharges.
- Observe site perimeter for evidence for potential of illicitly discharged or illegally dumped material, which may enter the job site.

## ***Identification of Illicit Connections and Illegal Dumping or Discharges***

- **General** – unlabeled and unidentifiable material should be treated as hazardous.
- **Solids** - Look for debris, or rubbish piles. Solid waste dumping often occurs on roadways with light traffic loads or in areas not easily visible from the traveled way.
- **Liquids** - signs of illegal liquid dumping or discharge can include:
  - Visible signs of staining or unusual colors to the pavement or surrounding adjacent soils
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Abnormal water flow during the dry weather season
- **Urban Areas** - Evidence of illicit connections or illegal discharges is typically detected at storm drain outfall locations or at manholes. Signs of an illicit connection or illegal discharge can include:
  - Abnormal water flow during the dry weather season
  - Unusual flows in sub drain systems used for dewatering
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Excessive sediment deposits, particularly adjacent to or near active offsite construction projects
- **Rural Areas** - Illicit connections or illegal discharges involving irrigation drainage ditches are detected by visual inspections. Signs of an illicit discharge can include:
  - Abnormal water flow during the non-irrigation season
  - Non-standard junction structures
  - Broken concrete or other disturbances at or near junction structures

## ***Reporting***

Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery. For illicit connections or discharges to the storm drain system, notify the local stormwater management agency. For illegal dumping, notify the local law enforcement agency.

## ***Cleanup and Removal***

The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the local stormwater management agency for further information.

## Costs

Costs to look for and report illicit connections and illegal discharges and dumping are low. The best way to avoid costs associated with illicit connections and illegal discharges and dumping is to keep the project perimeters secure to prevent access to the site, to observe the site for vehicles that should not be there, and to document any waste or hazardous materials that exist onsite before taking possession of the site.

## Inspection and Maintenance

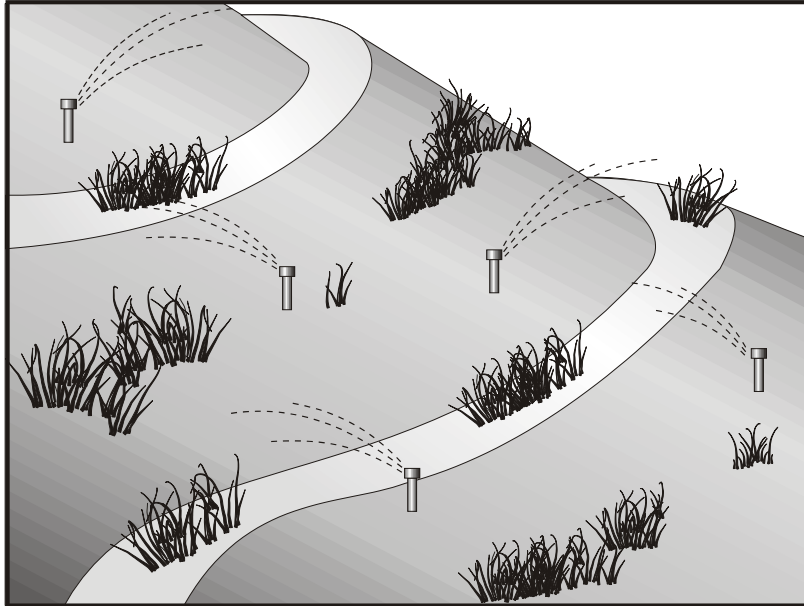
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect the site regularly to check for any illegal dumping or discharge.
- Prohibit employees and subcontractors from disposing of non-job-related debris or materials at the construction site.
- Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery.

## References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Potable Water/Irrigation consists of practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing.

## Suitable Applications

Implement this BMP whenever potable water or irrigation water discharges occur at or enter a construction site.

## Limitations

None identified.

## Implementation

- Direct water from offsite sources around or through a construction site, where feasible, in a way that minimizes contact with the construction site.
- Discharges from water line flushing should be reused for landscaping purposes where feasible.
- Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow.
- Protect downstream stormwater drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- Inspect irrigated areas within the construction limits for excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used and to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.

## **Costs**

Cost to manage potable water and irrigation are low and generally considered to be a normal part of related activities.

## **Inspection and Maintenance**

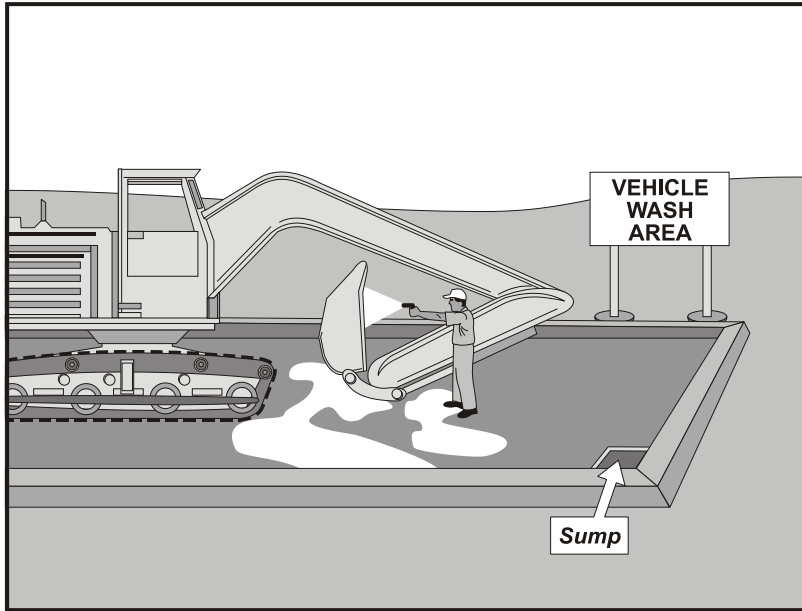
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Repair broken water lines as soon as possible.
- Inspect irrigated areas regularly for signs of erosion and/or discharge.

## **References**

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

## Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment cleaning is performed.

## Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

## Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runoff and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

## Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

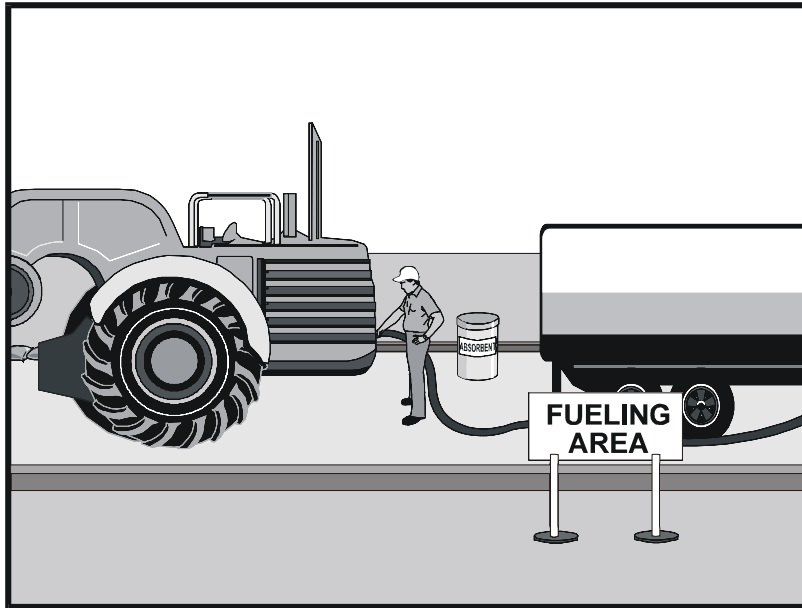
## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.



## Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

## Suitable Applications

These procedures are suitable on all construction sites where vehicle and equipment fueling takes place.

## Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/ Exit.

## Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage “topping-off” of fuel tanks.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None

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- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runoff and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

## Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

## Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately, or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.

- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

## References

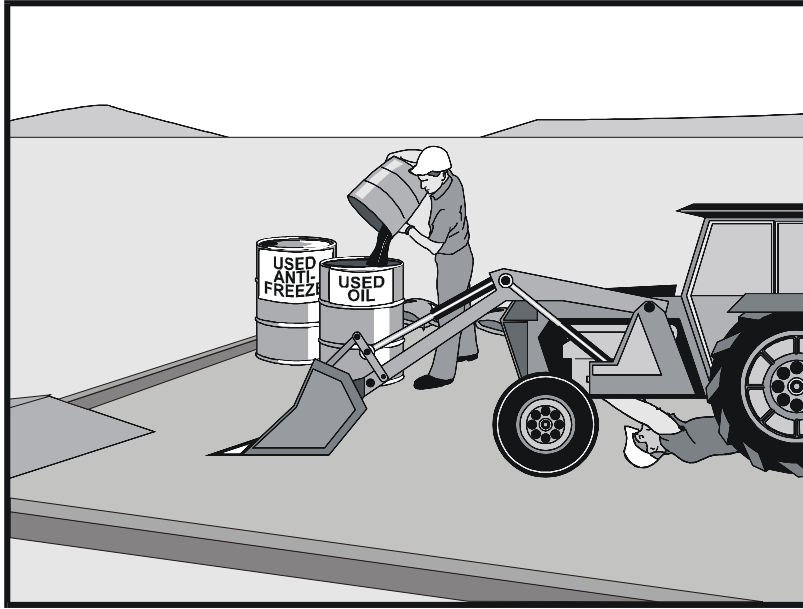
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

# Vehicle & Equipment Maintenance NS-10



## Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a “dry and clean site”. The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

## Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

## Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TC-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8,

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ Primary Objective
- ☒ Secondary Objective

## Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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# Vehicle & Equipment Maintenance NS-10

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Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

## Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runoff and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.

# Vehicle & Equipment Maintenance NS-10

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- Repair leaks of fluids and oil immediately.

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

## ***Safer Alternative Products***

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an “environmentally friendly” label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

## ***Waste Reduction***

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The “chlor” term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

## ***Recycling and Disposal***

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like, -trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

## ***Costs***

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

# Vehicle & Equipment Maintenance NS-10

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## Inspection and Maintenance

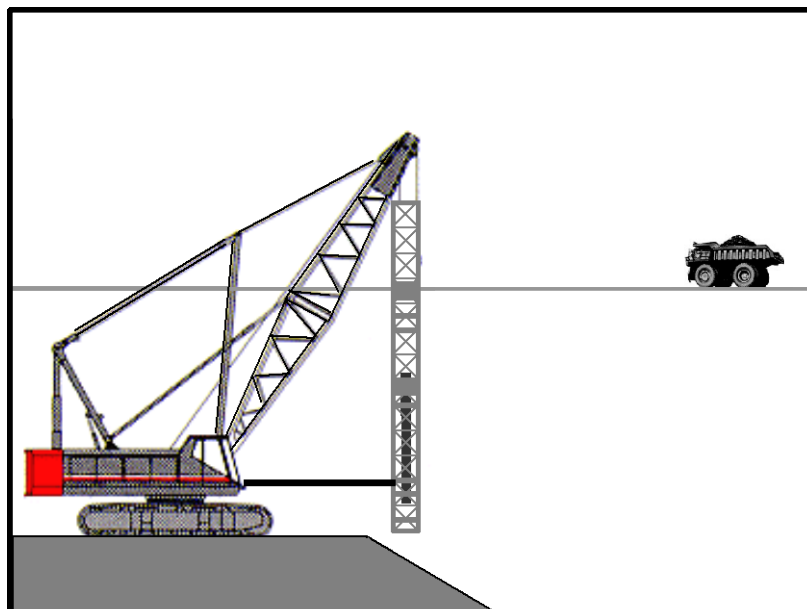
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately, or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

## References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



## Description and Purpose

The construction and retrofit of bridges and retaining walls often include driving piles for foundation support and shoring operations. Driven piles are typically constructed of precast concrete, steel, or timber. Driven sheet piles are also used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce or eliminate the discharge of potential pollutants to the storm drain system, watercourses, and waters of the United States.

## Suitable Applications

These procedures apply to all construction sites near or adjacent to a watercourse or groundwater where permanent and temporary pile driving (impact and vibratory) takes place, including operations using pile shells as well as construction of cast-in-steel-shell and cast-in-drilled-hole piles.

## Limitations

None identified.

## Implementation

- Use drip pans or absorbent pads during vehicle and equipment operation, maintenance, cleaning, fueling, and storage. Refer to NS-8, Vehicle and Equipment Cleaning, NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None

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- Have spill kits and cleanup materials available at all locations of pile driving. Refer to WM-4, Spill Prevention and Control.
- Equipment that is stored or in use in streambeds, or on docks, barges, or other structures over water bodies should be kept leak free.
- Park equipment over plastic sheeting or equivalent where possible. Plastic is not a substitute for drip pans or absorbent pads. The storage or use of equipment in streambeds or other bodies of water must comply with all applicable permits.
- Implement other BMPs as applicable, such as NS-2, Dewatering Operations, WM-5, Solid Waste Management, WM-6, Hazardous Waste Management, and WM-10, Liquid Waste Management.
- When not in use, store pile-driving equipment away from concentrated flows of stormwater, drainage courses, and inlets. Protect hammers and other hydraulic attachments from runoff and runoff by placing them on plywood and covering them with plastic or a comparable material prior to the onset of rain.
- Use less hazardous products, e.g., vegetable oil, when practicable.

## Costs

All of the above measures can be low cost.

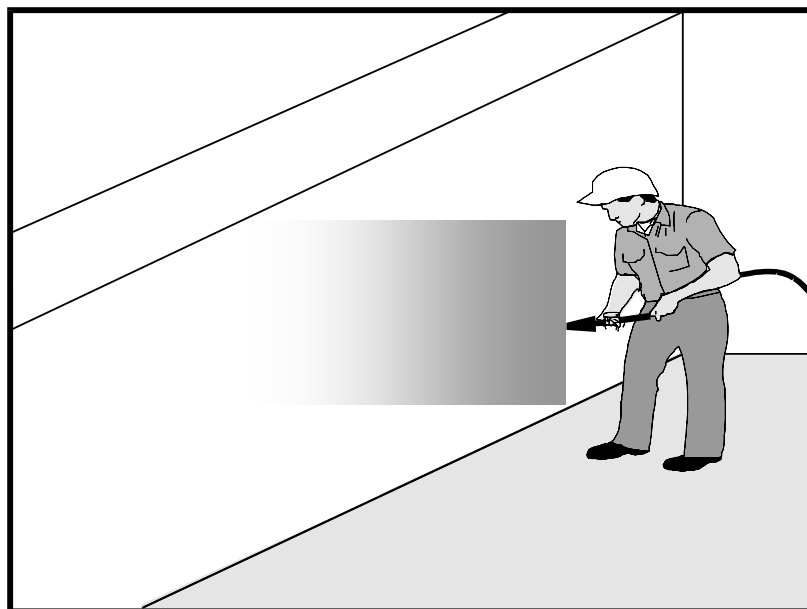
## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect equipment every day at startup and repair equipment as needed (i.e., worn or damaged hoses, fittings, and gaskets). Recheck equipment at shift changes or at the end of the day and scheduled repairs as needed.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

## Suitable Applications

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

## Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ Primary Category
- ☒ Secondary Category

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None

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## Implementation

### *Chemical Curing*

- Avoid over spray of curing compounds.
- Minimize the drift by applying the curing compound close to the concrete surface. Apply an amount of compound that covers the surface but does not allow any runoff of the compound.
- Use proper storage and handling techniques for concrete curing compounds. Refer to WM-1, Material Delivery and Storage.
- Protect drain inlets prior to the application of curing compounds.
- Refer to WM-4, Spill Prevention and Control.

### *Water Curing for Bridge Decks, Retaining Walls, and other Structures*

- Direct cure water away from inlets and watercourses to collection areas for evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.
- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

### *Education*

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

### **Costs**

All of the above measures are generally low cost.

### **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.

- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect cure containers and spraying equipment for leaks.

## References

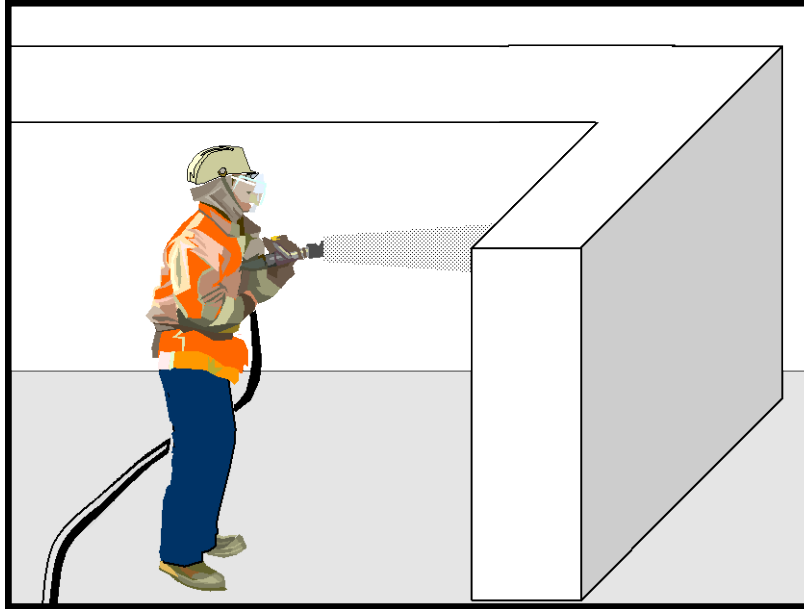
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non-Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.





## Description and Purpose

Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Methods include sand blasting, shot blasting, grinding, or high-pressure water blasting. Stormwater and non-stormwater exposed to concrete finishing by-products may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate BMPs can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Concrete and its associated curing materials have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

## Suitable Applications

These procedures apply to all construction locations where concrete finishing operations are performed.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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## Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

## Implementation

- Collect and properly dispose of water from high-pressure water blasting operations.
- Collect contaminated water from blasting operations at the top of slopes. Transport or dispose of contaminated water while using BMPs such as those for erosion control. Refer to EC-9, Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering). Refer to NS-2 Dewatering Operations.
- Protect inlets during sandblasting operations. Refer to SE-10, Storm Drain Inlet Protection.
- Refer to WM-8, Concrete Waste Management for disposal of concrete debris.
- Minimize the drift of dust and blast material as much as possible by keeping the blasting nozzle close to the surface.
- When blast residue contains a potentially hazardous waste, refer to WM-6, Hazardous Waste Management.

## Education

- Educate employees, subcontractors, and suppliers on proper concrete finishing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete finishing procedures.

## Costs

These measures are generally of low cost.

## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts concrete dust and debris as required by the General Permit.

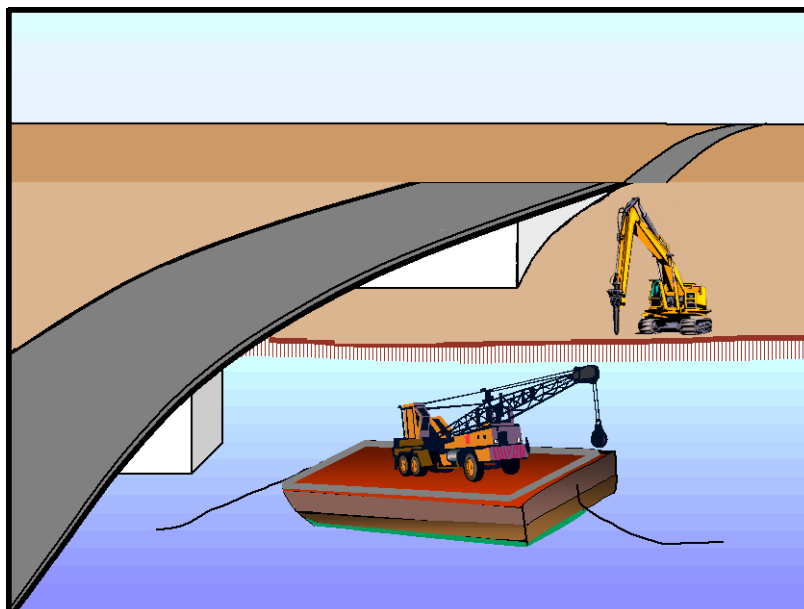
- Sweep or vacuum up debris from sandblasting at the end of each shift.
- At the end of each work shift, remove and contain liquid and solid waste from containment structures, if any, and from the general work area.
- Inspect containment structures for damage prior to use and prior to onset of forecasted rain.

## References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Procedures for the proper use, storage, and disposal of materials and equipment on barges, boats, temporary construction pads, or similar locations that minimize or eliminate the discharge of potential pollutants to a watercourse.

## Suitable Applications

Applies where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse including waters of the United States. These procedures should be implemented for construction materials and wastes (solid and liquid), soil or dredging materials, or any other materials that may cause or contribute to exceedances of water quality standards.

## Limitations

Dredge and fill activities are regulated by the US Army Corps of Engineers and Regional Boards under Section 404/401 of the Clean Water Act.

## Implementation

- Refer to WM-1, Material Delivery and Storage and WM-4, Spill Prevention and Control.
- Use drip pans and absorbent materials for equipment and vehicles and ensure that an adequate supply of spill clean up materials is available.
- Drip pans should be placed under all vehicles and equipment placed on docks, barges, or other structures over

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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water bodies when the vehicle or equipment is expected to be idle for more than 1 hour.

- Maintain equipment in accordance with NS-10, Vehicle and Equipment Maintenance. If a leaking line cannot be repaired, remove equipment from over the water.
- Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc.
- Secure all materials to prevent discharges to receiving waters via wind.
- Identify types of spill control measures to be employed, including the storage of such materials and equipment. Ensure that staff is trained regarding the use of the materials, deployment and access of control measures, and reporting measures.
- In case of spills, contact the local Regional Board as soon as possible but within 48 hours.
- Refer to WM-5, Solid Waste Management (non-hazardous) and WM-6, Hazardous Waste Management. Ensure the timely and proper removal of accumulated wastes
- Comply with all necessary permits required for construction within or near the watercourse, such as Regional Water Quality Control Board, U.S. Army Corps of Engineers, Department of Fish and Game or and other local permitting.
- Discharges to waterways should be reported to the Regional Water Quality Control Board immediately upon discovery. A written discharge notification must follow within 7 days. Follow the spill reporting procedures contained in SWPPP.

## Costs

These measures are generally of low to moderate cost. Exceptions are areas for temporary storage of materials, engine fluids, or wastewater pump out.

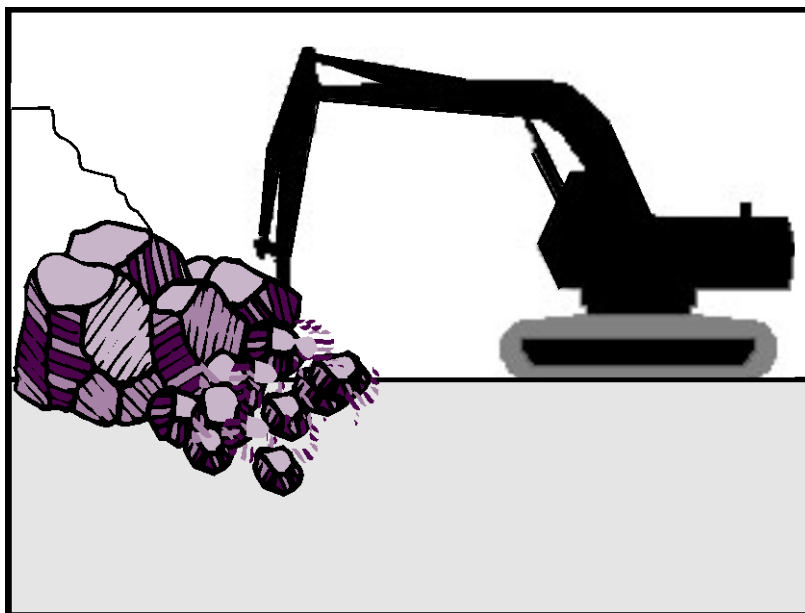
## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Ensure that employees and subcontractors implement the appropriate measures for storage and use of materials and equipment.
- Inspect and maintain all associated BMPs and perimeter controls to ensure continuous protection of the water courses, including waters of the United States.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Procedures to protect water bodies from debris and wastes associated with structure demolition or removal over or adjacent to watercourses.

## Suitable Applications

Full bridge demolition and removal, partial bridge removal (barrier rail, edge of deck) associated with bridge widening projects, concrete channel removal, or any other structure removal that could potentially affect water quality.

## Limitations

None identified.

## Implementation

- Refer to NS-5, Clear Water Diversion, to direct water away from work areas.
- Use attachments on construction equipment such as backhoes to catch debris from small demolition operations.
- Use covers or platforms to collect debris.
- Platforms and covers are to be approved by the owner.
- Stockpile accumulated debris and waste generated during demolition away from watercourses and in accordance with WM-3, Stockpile Management.
- Ensure safe passage of wildlife, as necessary.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- Discharges to waterways shall be reported to the Regional Water Quality Control Board immediately upon discovery. A written discharge notification must follow within 7 days. Follow the spill reporting procedures in the SWPPP.
- For structures containing hazardous materials, i.e., lead paint or asbestos, refer to BMP WM-6, Hazardous Waste Management. For demolition work involving soil excavation around lead-painted structures, refer to WM-7, Contaminated Soil Management.

## Costs

Cost may vary according to the combination of practices implemented.

## Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Any debris-catching devices shall be emptied regularly. Collected debris shall be removed and stored away from the watercourse and protected from runoff.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.





## Description and Purpose

The construction of roads, bridges, retaining walls, and other large structures in remote areas, often requires temporary batch plant facilities to manufacture Portland Cement Concrete (PCC) or asphalt cement (AC). Temporary batch plant facilities typically consist of silos containing fly ash, lime, and cement; heated tanks of liquid asphalt; sand and gravel material storage areas; mixing equipment; above ground storage tanks containing concrete additives and water; and designated areas for sand and gravel truck unloading, concrete truck loading, and concrete truck washout. Proper control and use of equipment, materials, and waste products from temporary batch plant facilities will reduce the discharge of potential pollutants to the storm drain system or watercourses, reduce air emissions, and mitigate noise impacts.

The General Permit draft incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements). Many types of batch plant materials, including mortar, concrete, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows which may cause an exceedance of the General Permit requirements.

## Suitable Applications

These procedures typically apply to construction sites where temporary batch plant facilities are used; however, some of the

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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practices described are applicable to construction sites with general concrete use.

## Limitations

The General Permit for discharges of stormwater associated with industrial activities (General Industrial Permit) may be applicable to temporary batch plants.

Specific permit requirements or mitigation measures such as Air Resources Board (ARB), Air Quality Management District (AQMD), Air Pollution Control District (APCD, Regional Water Quality Control Board (RWQCB), county ordinances and city ordinances may require alternative mitigation measures for temporary batch plants. Contact the local regulatory agencies to determine if a permit is required.

## Implementation

### *Planning*

- Temporary batch plants may be subject to the General Industrial Permit. To obtain a copy of this permit and the application forms, visit <http://www.waterboards.ca.gov> or contact the State Water Resources Control Board.
- Proper planning, design, and construction of temporary batch plants should be implemented to minimize potential water quality, air pollution, and noise impacts associated with temporary batch plants.
- BMPs and a Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP). BMPs should be implemented, inspected, and maintained in accordance with these plans.
- Temporary batch plants should be managed to comply with AQMD Statewide Registration Program and/or local AQMD Portable Equipment Registration requirements.
- Construct temporary batch plants downwind of existing developments whenever possible.
- Placement of access roads should be planned to mitigate water and air quality impacts.

### *Layout and Design*

- Temporary batch plants should be properly located and designed to mitigate water quality impacts to receiving water bodies. Batch plants should be located away from watercourses, drainage courses, and drain inlets. Batch plants should be located to minimize the potential for stormwater runoff onto the site.
- Temporary batch plant facilities (including associated stationary equipment and stockpiles) should be located at least 300 ft from any recreational area, school, residence, or other structure not associated with the construction project.
- Construct continuous interior AC or PCC berms around batch plant equipment (mixing equipment, silos, concrete drop points, conveyor belts, admixture tanks, etc.) to facilitate proper containment and cleanup of releases. Rollover or flip top curbs or dikes should be placed at ingress and egress points (SE-12, Temporary Silt Dike).
- Direct runoff from the paved or unpaved portion of the batch plant into a sump and pipe to a lined washout area or dewatering tank.

- Direct stormwater and non-stormwater runoff from unpaved portions of batch plant facility to catchment ponds or tanks.
- Construct and remove concrete washout facilities in accordance with WM-8, Concrete Waste Management.
- Layout of a typical batch plant and associated BMP is located at the end of this BMP fact sheet.

## ***Operational Procedures***

- Washout of concrete trucks should be conducted in a designated area in accordance with WM-8, Concrete Waste Management.
- Do not dispose of concrete into drain inlets, the stormwater drainage system, or watercourses.
- Washing of concrete mixing and transport equipment (including concrete truck washout) should occur in a designated area in accordance with WM-8, Concrete Waste Management.
- Washing equipment, tools, or vehicles to remove PCC should be conducted in accordance with NS-7, Potable Water/Irrigation, NS-8, Vehicle and Equipment Cleaning, and WM-8, Concrete Waste Management.
- All dry material transfer points should be ducted through a fabric or cartridge type filter unless there are no visible emissions from the transfer point.
- Equip all bulk storage silos, including auxiliary bulk storage trailers, with fabric or cartridge type filter(s).
- Maintain silo vent filters in proper operating condition.
- Equip silos and auxiliary bulk storage trailers with dust-tight service hatches.
- Fabric dust collection system should be capable of controlling particulate matter in accordance with the California Air Resources Control Board and local Air Pollution Control District Regulations.
- Fabric dust collectors (except for vent filters) should be equipped with an operational pressure differential gauge to measure the pressure drop across the filters.
- All transfer points should be equipped with a wet suppression system to control fugitive particulate emissions unless there are no visible emissions.
- All conveyors should be covered, unless the material being transferred results in no visible emissions.
- There should be no visible emissions beyond the property line, while the equipment is being operated.
- Collect dust emissions from the loading of open-bodied trucks, at the drip point of dry batch plants, or dust emissions from the drum feed for central mix plants.

- Equip silos and auxiliary bulk storage trailers with a visible and/or audible warning mechanism to warn operators that the silo or trailer is full.
- All open-bodied vehicles transporting material should be loaded with a final layer of wet sand and the truck should be covered with a tarp to reduce emissions.

## ***Tracking Control***

- Plant roads (batch truck and material delivery truck roads) and areas between stockpiles and conveyor hoppers should be stabilized (TC-2, Stabilized Construction Roadway), watered, treated with dust-suppressant chemicals (WE-1, Wind Erosion Control), or paved with a cohesive hard surface that can be repeatedly swept, maintained intact, and cleaned as necessary to control dust emissions.
- Trucks should not track PCC from plants onto public roads. Use appropriate practices from TC-1, Stabilized Construction Entrance/Exit, to prevent tracking.

## ***Materials Storage***

- WM-1, Material Delivery and Storage, should be implemented at all batch plants using concrete components or compounds. An effective strategy is to cover and contain materials.
- WM-2, Material Use should be conducted in a way to minimize or eliminate the discharge of materials to storm drain system or watercourse.
- Ensure that finer materials are not dispersed into the air during operations, such as unloading of cement delivery trucks.
- Stockpiles should be covered and enclosed with perimeter sediment barriers per WM-3, Stockpile Management. Uncovered stockpiles should be sprayed with water and/or dust-suppressant chemicals as necessary to control dust emissions, unless the stockpiled material results in no visible emissions. An operable stockpile watering system should be onsite at all times.
- Store bagged and boxed materials on pallets and cover or store in a completely enclosed storage area on non-working days and prior to rain.
- Minimize stockpiles of demolished PCC by recycling them in a timely manner.
- Provide secondary containment for liquid materials (WM-1, Material Delivery and Storage, WM-10, Liquid Waste Management). Containment should provide sufficient volume to contain precipitation from a 25-year storm plus 10% of the aggregate volume of all containers or plus 100% of the largest container, whichever is greater.
- Handle solid and liquid waste in accordance with WM-5, Solid Waste Management, WM-10, Liquid Waste Management, and WM-8, Concrete Waste Management.
- Maintain adequate supplies of spill cleanup materials and train staff to respond to spills per WM-4, Spill Prevention and Control.
- Immediately contain and clean up spilled cement and fly ash and contain.

## ***Equipment Maintenance***

- Equipment should be maintained to prevent fluid leaks and spills per NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.
- Maintain adequate supplies of spill cleanup materials and train staff to respond to spills per WM-4, Spill Prevention and Control.
- Incorporate other BMPs such as WM-5, Solid Waste Management, WM-6, Hazardous Waste Management, and WM-10, Liquid Waste Management.

## **Costs**

Costs will vary depending on the size of the facility and combination of BMPs implemented.

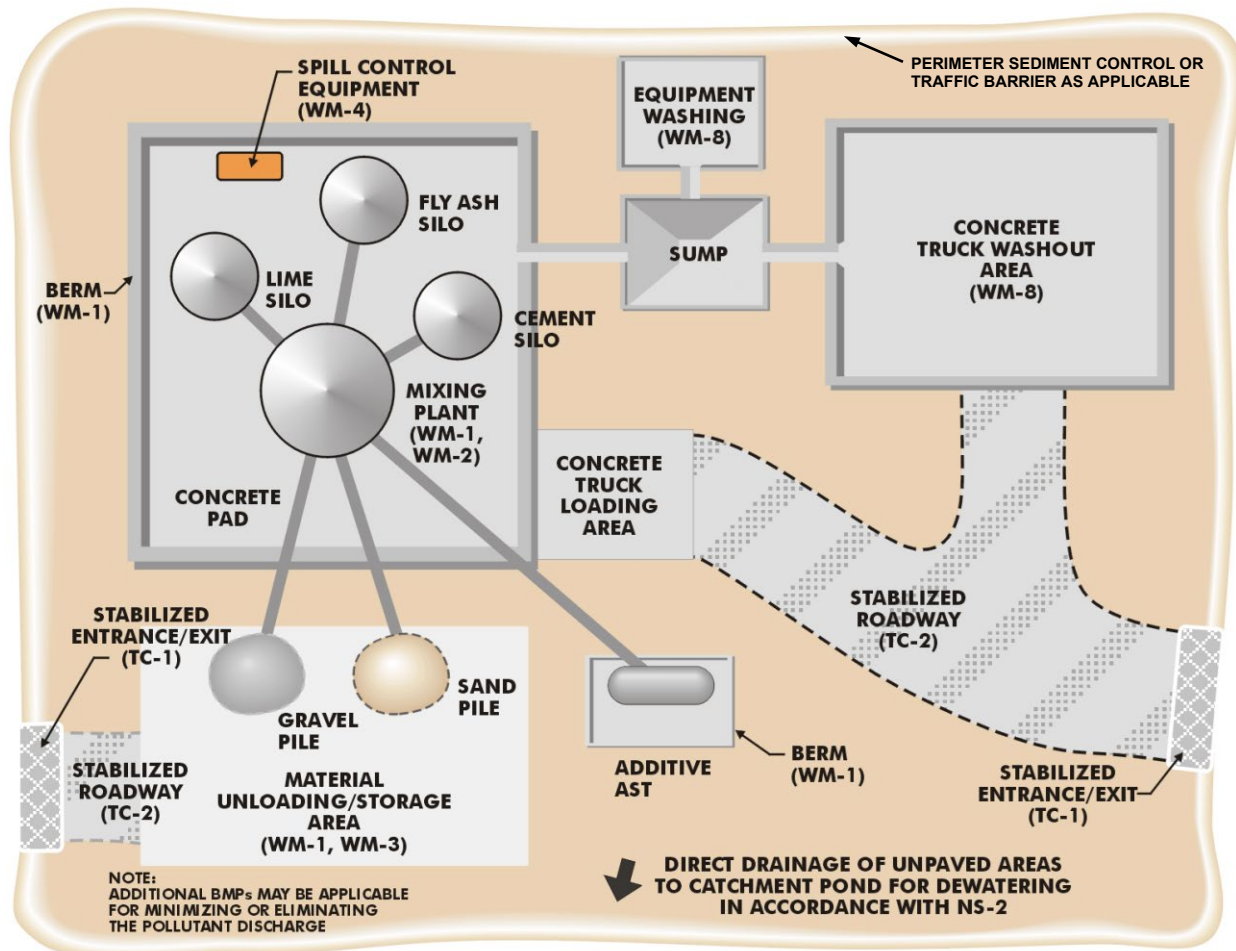
## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts cementitious materials or fly ash as required by the General Permit.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).
- Inspect and maintain a Stabilized Construction Entrance/Exit (TC-1) as needed.
- Inspect and maintain stabilized haul roads as needed (TC-2, Stabilized Construction Roadway).
- Inspect and maintain materials and waste storage areas as needed.

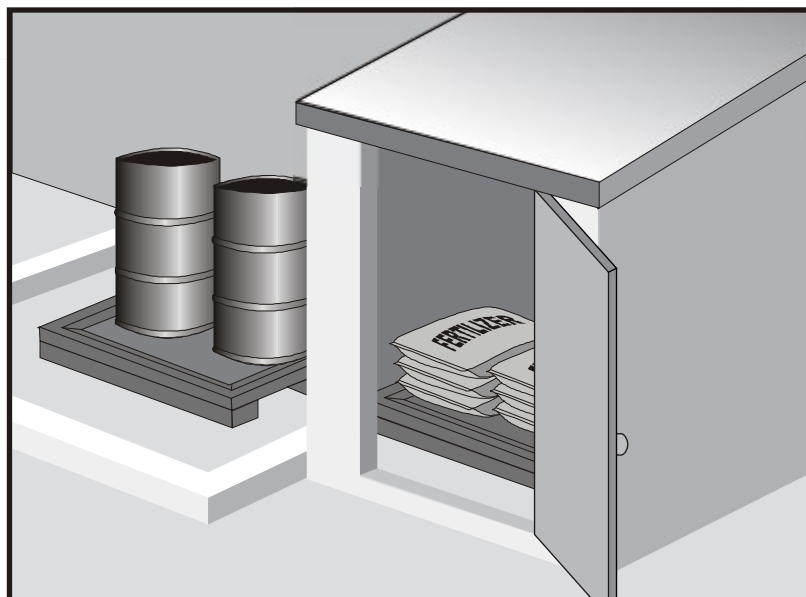
## **References**

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**Typical Temporary Batch**



## Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

## Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

## Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

## Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.



- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

## ***Material Storage Areas and Practices***

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

## ***Material Delivery Practices***

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

## ***Spill Cleanup***

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

## **Cost**

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

## **Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

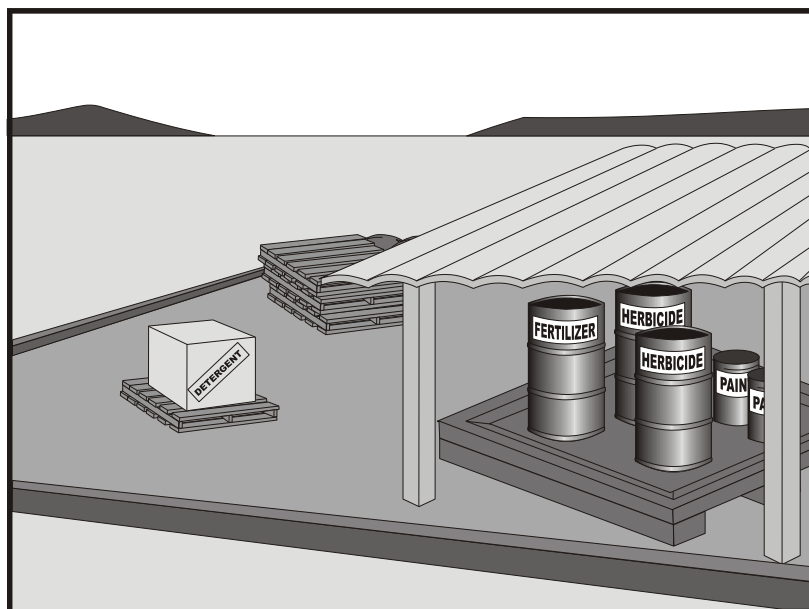
## References

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Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

## Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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## Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

## Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

## **Costs**

All of the above are low cost measures.

## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

## **References**

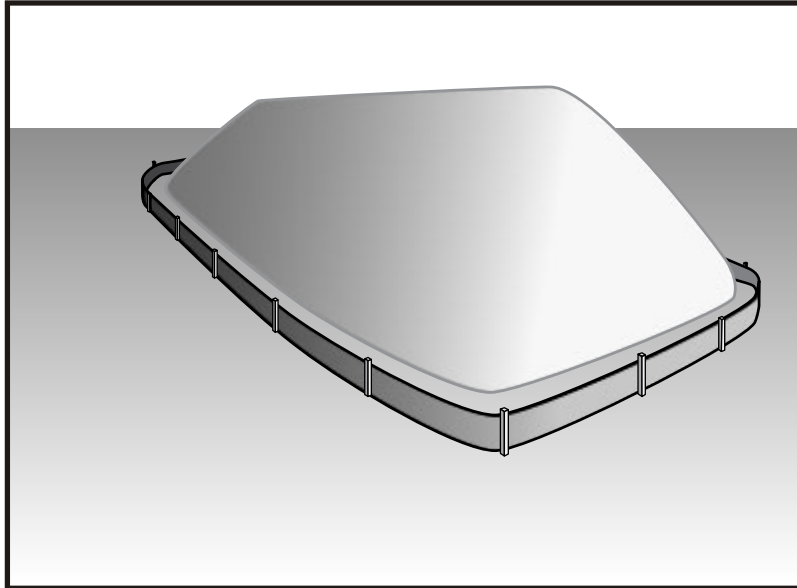
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP-2005-0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006. Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as Portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called “cold mix” asphalt), and pressure treated wood.

## Suitable Applications

Implement in all projects that stockpile soil and other loose materials.

## Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

## Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

## Treat Categories

EC	Erosion Control	
SE	Sediment Control	<input checked="" type="checkbox"/>
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.
- After 14 days of inactivity, a stockpile is non-active and requires further protection described below. All stockpiles are required to be protected as non-active stockpiles immediately if they are not scheduled to be used within 14 days.
- Protect all stockpiles from stormwater run-on using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

## ***Protection of Non-Active Stockpiles***

A stockpile is considered non-active if it either is not used for 14 days or if it is scheduled not to be used for 14 days or more. Stockpiles need to be protected immediately if they are not scheduled to be used within 14 days. Non-active stockpiles of the identified materials should be protected as follows:

### *Soil stockpiles*

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

### *Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base*

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

### *Stockpiles of “cold mix”*

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

### *Stockpiles of fly ash, stucco, hydrated lime*

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

### *Stockpiles/Storage of treated wood*

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

### **Protection of Active Stockpiles**

A stockpile is active when it is being used or is scheduled to be used within 14 days of the previous use. Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of “cold mix” and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

### **Costs**

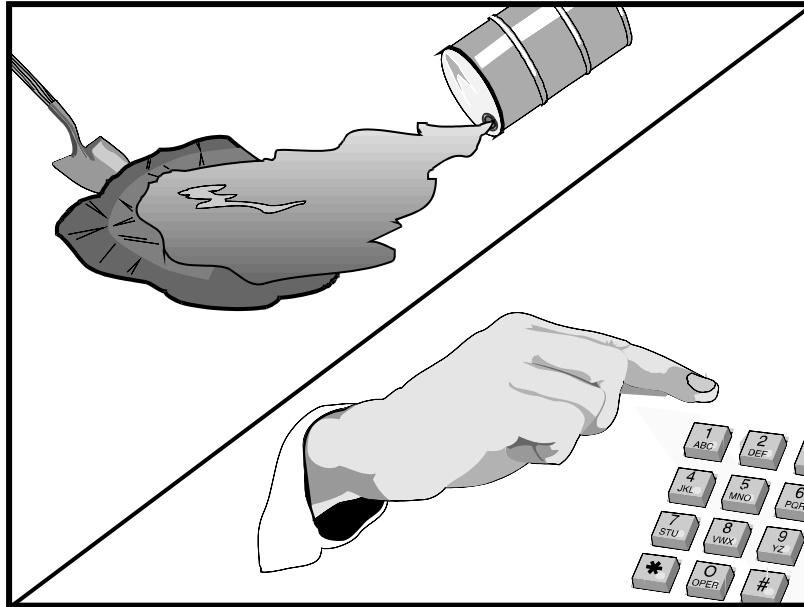
For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

### **Inspection and Maintenance**

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.
- Sediment shall be removed when it reaches one-third of the barrier height.

### **References**

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.



## Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

## Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- Fuels
- Lubricants
- Other petroleum distillates

## **Limitations**

- In some cases, it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

## **Implementation**

The following steps will help reduce the stormwater impacts of leaks and spills:

### ***Education***

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a “significant spill” is for each material they use, and what is the appropriate response for “significant” and “insignificant” spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor’s superintendent or representative oversee and enforce proper spill prevention and control measures.

### ***General Measures***

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runoff during rainfall to the extent that it doesn’t compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

## ***Cleanup***

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

## ***Minor Spills***

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

## ***Semi-Significant Spills***

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

## ***Significant/Hazardous Spills***

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110, 119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spill's contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

## ***Reporting***

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

## ***Vehicle and Equipment Maintenance***

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

## ***Vehicle and Equipment Fueling***

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

## **Costs**

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

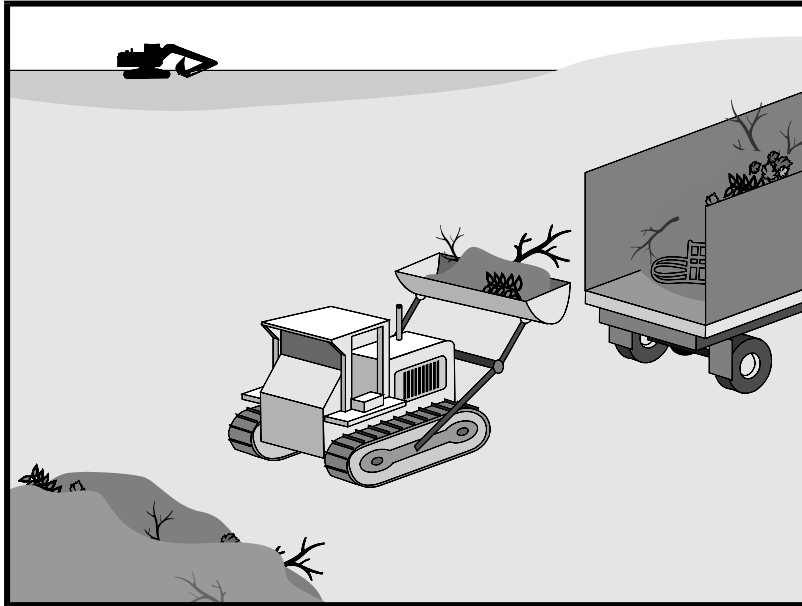
## References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.





## Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

## Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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- Highway planting wastes, including vegetative material, plant containers, and packaging materials

## Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

## Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Cover waste containers at the end of each work day and when it is raining.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

## Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.

- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

## ***Collection, Storage, and Disposal***

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runoff should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.
- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

## **Costs**

All of the above are low cost measures.

## **Inspection and Maintenance**

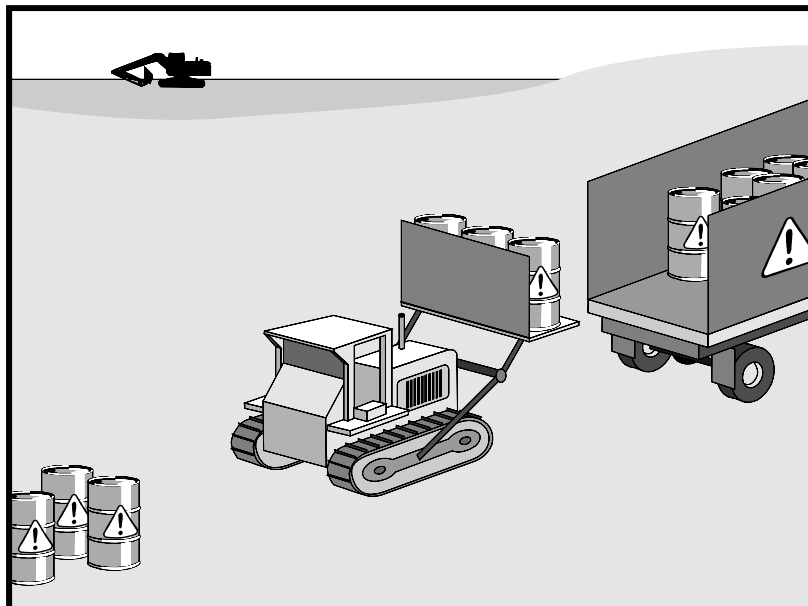
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

## **References**

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

## Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Concrete Curing Compounds
- Palliatives
- Septic Wastes
- Stains
- Wood Preservatives
- Asphalt Products
- Pesticides
- Acids
- Paints
- Solvents
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
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## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

## Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

## Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

### *Material Use*

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
  - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.
- Drums should not be overfilled, and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil-based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. “Paint out” brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- The following actions should be taken with respect to temporary contaminant:
  - Ensure that adequate hazardous waste storage volume is available.
  - Ensure that hazardous waste collection containers are conveniently located.
  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
  - Minimize production or generation of hazardous materials and hazardous waste on the job site.
  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.
  - Segregate potentially hazardous waste from non-hazardous construction site debris.
  - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

## ***Waste Recycling Disposal***

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

## ***Disposal Procedures***

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.



## ***Education***

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

## **Costs**

All of the above are low cost measures.

## ***Inspection and Maintenance***

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.
- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

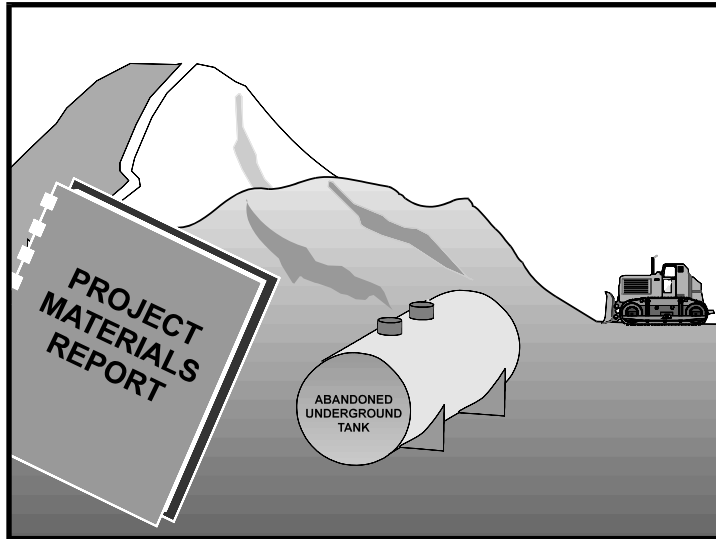
## References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

## Suitable Applications

Contaminated soil management is implemented on construction projects in highly urbanized or industrial areas where soil contamination may have occurred due to spills, illicit discharges, aerial deposition, past use and leaks from underground storage tanks.

## Limitations

Contaminated soils that cannot be treated onsite must be disposed of offsite by a licensed hazardous waste hauler. The presence of contaminated soil may indicate contaminated water as well. See NS-2, Dewatering Operations, for more information.

The procedures and practices presented in this BMP are general. The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered onsite.

## Implementation

Most owners and developers conduct pre-construction environmental assessments as a matter of routine. Contaminated soils are often identified during project planning and development with known locations identified in the plans, specifications and in the SWPPP. The contractor should review applicable reports and investigate appropriate call-outs in the

## Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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plans, specifications, and SWPPP. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil highlight the need for contractors to confirm a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough, pre-construction inspections of the site and review documents related to the site. If inspection or reviews indicated presence of contaminated soils, develop a plan before starting work.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills. Contaminated soil can be expensive to treat and dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- The contractor may further identify contaminated soils by investigating:
  - Past site uses and activities
  - Detected or undetected spills and leaks
  - Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline forming elements
  - Contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
  - Suspected soils should be tested at a certified laboratory.

## ***Education***

- Have employees and subcontractors complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified, prior to performing any excavation work at the locations containing material classified as hazardous.
- Educate employees and subcontractors in identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

## ***Handling Procedures for Material with Aerially Deposited Lead (ADL)***

- Materials from areas designated as containing (ADL) may, if allowed by the contract special provisions, be excavated, transported, and used in the construction of embankments and/or backfill.
- Excavation, transportation, and placement operations should result in no visible dust.
- Caution should be exercised to prevent spillage of lead containing material during transport.

- Quality should be monitored during excavation of soils contaminated with lead.

## ***Handling Procedures for Contaminated Soils***

- Minimize onsite storage. Contaminated soil should be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 66265.250 to 66265.260.
- Test suspected soils at an approved certified laboratory.
- Work with the local regulatory agencies to develop options for treatment or disposal if the soil is contaminated.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- Take the following precautions if temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.
- Remove contaminated material and hazardous material on exteriors of transport vehicles and place either into the current transport vehicle or into the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and treat or dispose of it at an appropriate disposal site.
- Collect non-reusable protective equipment, once used by any personnel, and dispose of at an appropriate disposal site.
- Install temporary security fence to surround and secure the exclusion zone. Remove fencing when no longer needed.
- Excavate, transport, and dispose of contaminated material and hazardous material in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - United States Department of Transportation (USDOT)
  - United States Environmental Protection Agency (USEPA)
  - California Environmental Protection Agency (CAL-EPA)

- California Division of Occupation Safety and Health Administration (CAL-OSHA)
- Local regulatory agencies

## ***Procedures for Underground Storage Tank Removals***

- Prior to commencing tank removal operations, obtain the required underground storage tank removal permits and approval from the federal, state, and local agencies that have jurisdiction over such work.
- To determine if it contains hazardous substances, arrange to have tested, any liquid or sludge found in the underground tank prior to its removal.
- Following the tank removal, take soil samples beneath the excavated tank and perform analysis as required by the local agency representative(s).
- The underground storage tank, any liquid or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal and transported to disposal facilities permitted to accept such waste.

## ***Water Control***

- All necessary precautions and preventive measures should be taken to prevent the flow of water, including ground water, from mixing with hazardous substances or underground storage tank excavations. Such preventative measures may consist of, but are not limited to, berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.
- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, should be discharged to clean, closed top, watertight transportable holding tanks, treated, and disposed of in accordance with federal, state, and local laws.

## ***Costs***

Prevention of leaks and spills is inexpensive. Treatment or disposal of contaminated soil can be quite expensive.

## ***Inspection and Maintenance***

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for contractor's Water Pollution Control Manager, foreman, and/or construction supervisor to monitor onsite contaminated soil storage and disposal procedures.
- Monitor air quality continuously during excavation operations at all locations containing hazardous material.
- Coordinate contaminated soils and hazardous substances/waste management with the appropriate federal, state, and local agencies.

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

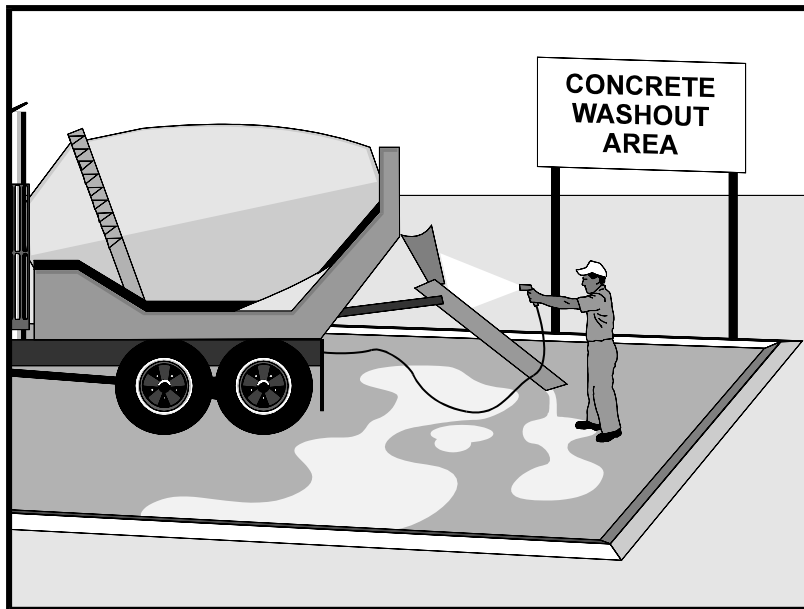
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Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Prevent the discharge of pollutants to stormwater from concrete waste by conducting washout onsite or offsite in a designated area, and by employee and subcontractor training.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

## Suitable Applications

Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result from demolition activities.
- Slurries containing Portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.
- Concrete trucks and other concrete-coated equipment are washed onsite.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	<input checked="" type="checkbox"/>
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Category**
- ☒ **Secondary Category**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	
Organics	

## Potential Alternatives

None

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- Mortar-mixing stations exist.
- Stucco mixing and spraying.
- See also NS-8, Vehicle and Equipment Cleaning.

## Limitations

- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

## Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washouts shall be implemented in a manner that prevents leaching to underlying soils. Washout containers must be water tight and washouts on or in the ground must be lined with a suitable impervious liner, typically a plastic type material.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.
- See typical concrete washout installation details at the end of this fact sheet.

## Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.

- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.
- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.

## ***Concrete Demolition Wastes***

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.
- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

## ***Concrete Slurry Wastes***

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut concrete slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine or by sweeping. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Concrete slurry residue should be disposed in a temporary washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

## ***Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures***

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of or recycled offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of or recycle hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
  - Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag Barrier).
  - Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
  - Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a “roll-off”; this concrete washout facility should be properly sealed to prevent leakage and should be removed from the site and replaced when the container reaches 75% capacity.
- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

## ***Removal of Temporary Concrete Washout Facilities***

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations.
- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

## **Costs**

All of the above are low cost measures. Roll-off concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

## **Inspection and Maintenance**

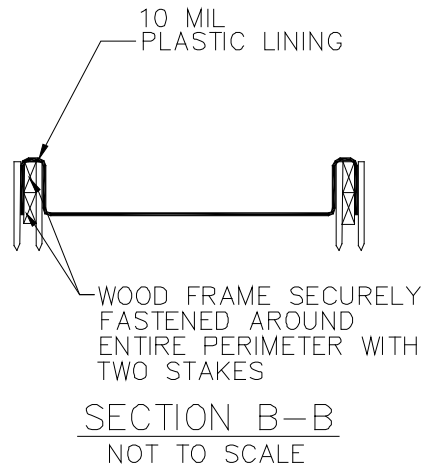
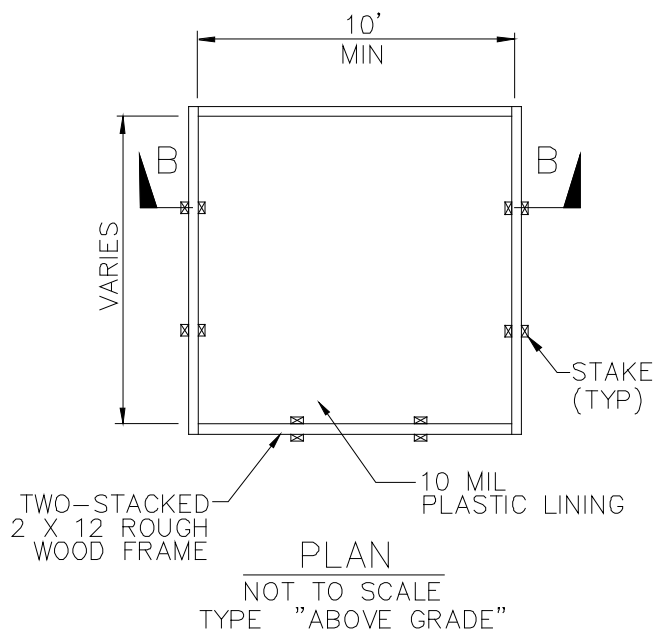
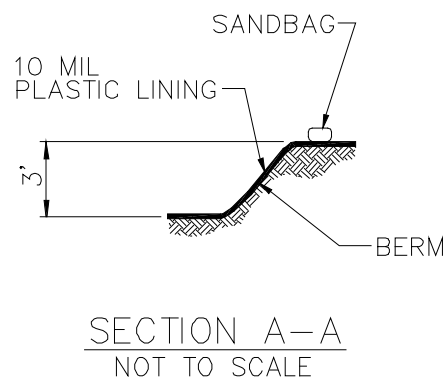
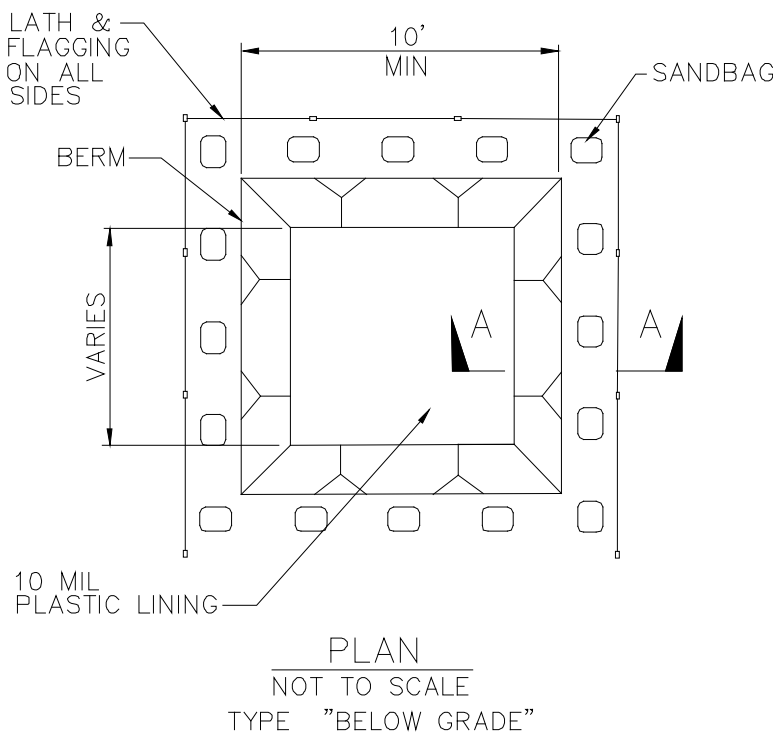
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and properly disposed or recycled in accordance with federal, state or local regulations.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

## **References**

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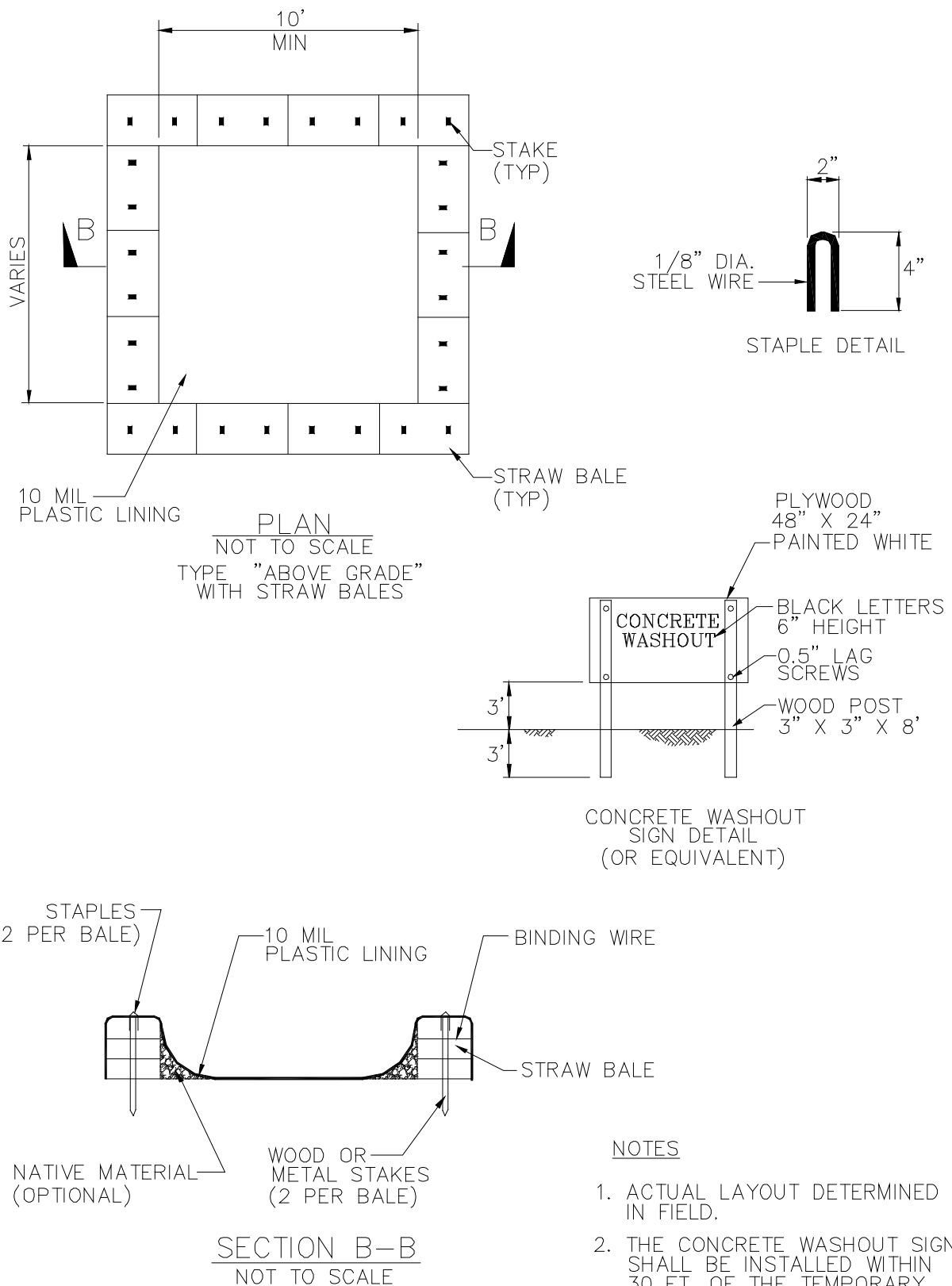
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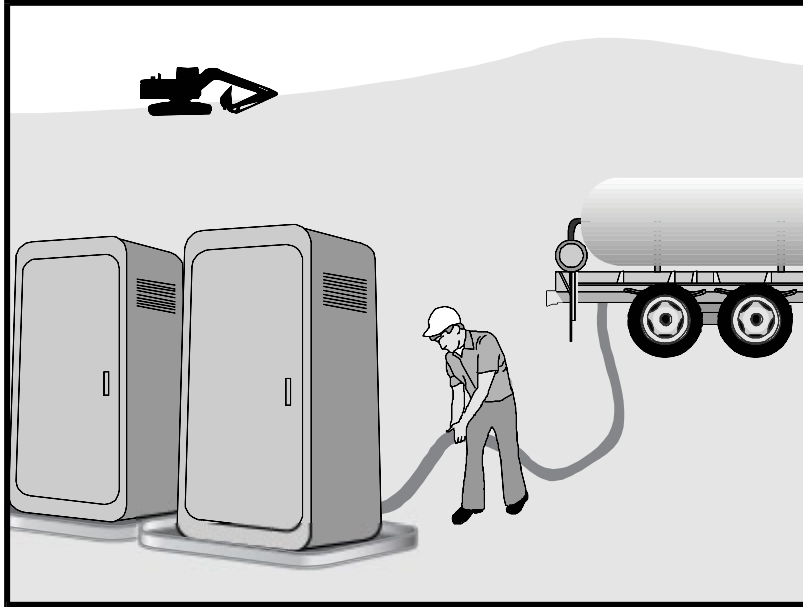


## NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



# Sanitary/Septic Waste Management WM-9



## Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

## Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

## Limitations

None identified.

## Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

## Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ Primary Category
- ☒ Secondary Category

## Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	
Organics	<input checked="" type="checkbox"/>

## Potential Alternatives

None

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# **Sanitary/Septic Waste Management WM-9**

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- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

## ***Education***

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce the use of sanitary facilities (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

## **Costs**

All of the above are low cost measures.



# **Sanitary/Septic Waste Management WM-9**

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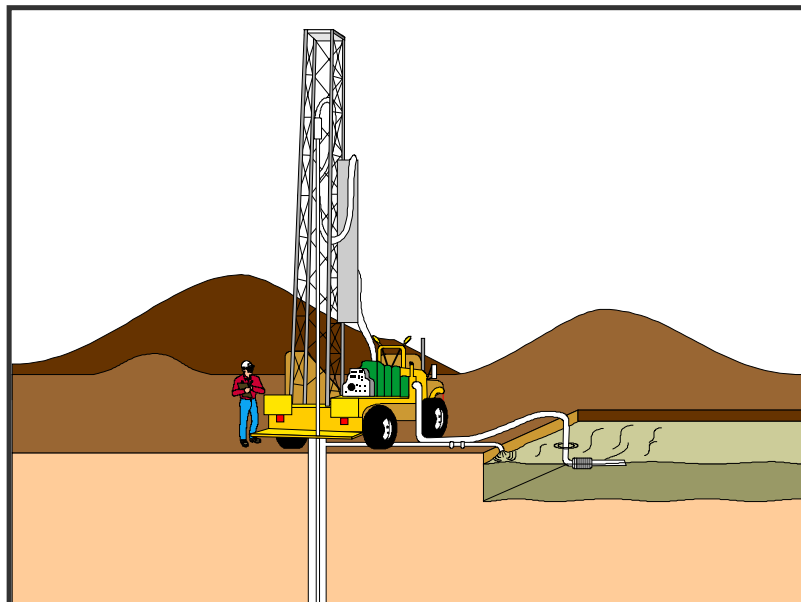
## **Inspection and Maintenance**

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

## **References**

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



## Description and Purpose

Liquid waste management includes procedures and practices to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes.

## Suitable Applications

Liquid waste management is applicable to construction projects that generate any of the following non-hazardous by-products, residuals, or wastes:

- Drilling slurries and drilling fluids
- Grease-free and oil-free wastewater and rinse water
- Dredgings
- Other non-stormwater liquid discharges not permitted by separate permits

## Limitations

- Disposal of some liquid wastes may be subject to specific laws and regulations or to requirements of other permits secured for the construction project (e.g., NPDES permits, Army Corps permits, Coastal Commission permits, etc.).
- Liquid waste management does not apply to dewatering operations (NS-2 Dewatering Operations), solid waste management (WM-5, Solid Waste Management), hazardous wastes (WM-6, Hazardous Waste Management), or

## Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	<input checked="" type="checkbox"/>

## Legend:

- ☒ **Primary Objective**
- ☒ **Secondary Objective**

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	

## Potential Alternatives

None

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concrete slurry residue (WM-8, Concrete Waste Management).

- Typical permitted non-stormwater discharges can include: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; flows from riparian habitats and wetlands; and discharges or flows from emergency fire fighting activities.

## **Implementation**

### ***General Practices***

- Instruct employees and subcontractors how to safely differentiate between non-hazardous liquid waste and potential or known hazardous liquid waste.
- Instruct employees, subcontractors, and suppliers that it is unacceptable for any liquid waste to enter any storm drainage device, waterway, or receiving water.
- Educate employees and subcontractors on liquid waste generating activities and liquid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Verify which non-stormwater discharges are permitted by the statewide NPDES permit; different regions might have different requirements not outlined in this permit.
- Apply NS-8, Vehicle and Equipment Cleaning for managing wash water and rinse water from vehicle and equipment cleaning operations.

### ***Containing Liquid Wastes***

- Drilling residue and drilling fluids should not be allowed to enter storm drains and watercourses and should be disposed of.
- If an appropriate location is available, drilling residue and drilling fluids that are exempt under Title 23, CCR § 2511(g) may be dried by infiltration and evaporation in a containment facility constructed in conformance with the provisions concerning the Temporary Concrete Washout Facilities detailed in WM-8, Concrete Waste Management.
- Liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.
- Liquid wastes should be contained in a controlled area such as a holding pit, sediment basin, roll-off bin, or portable tank.
- Containment devices must be structurally sound and leak free.
- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated.

- Precautions should be taken to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in WM-4, Spill Prevention and Control.
- Containment areas or devices should not be located where accidental release of the contained liquid can threaten health or safety or discharge to water bodies, channels, or storm drains.

## ***Capturing Liquid Wastes***

- Capture all liquid wastes that have the potential to affect the storm drainage system (such as wash water and rinse water from cleaning walls or pavement), before they run off a surface.
- Do not allow liquid wastes to flow or discharge uncontrolled. Use temporary dikes or berms to intercept flows and direct them to a containment area or device for capture.
- Use a sediment trap (SE-3, Sediment Trap) for capturing and treating sediment laden liquid waste or capture in a containment device and allow sediment to settle.

## ***Disposing of Liquid Wastes***

- A typical method to handle liquid waste is to dewater the contained liquid waste, using procedures such as described in NS-2, Dewatering Operations, and SE-2, Sediment Basin, and dispose of resulting solids per WM-5, Solid Waste Management.
- Methods of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 or 404 permits, and local agency discharge permits, etc. Review the SWPPP to see if disposal methods are identified.
- Liquid wastes, such as from dredged material, may require testing and certification whether it is hazardous or not before a disposal method can be determined.
- For disposal of hazardous waste, see WM-6, Hazardous Waste Management.
- If necessary, further treat liquid wastes prior to disposal. Treatment may include, though is not limited to, sedimentation, filtration, and chemical neutralization.

## **Costs**

Prevention costs for liquid waste management are minimal. Costs increase if cleanup or fines are involved.

## **Inspection and Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Remove deposited solids in containment areas and capturing devices as needed and at the completion of the task. Dispose of any solids as described in WM-5, Solid Waste Management.
- Inspect containment areas and capturing devices and repair as needed.

## References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

## Section 5

# Glossary and List of Acronyms

### 5.1 Glossary

**303(d) Listed:** Water bodies listed as impaired as per Section 303(d) of the 1972 CWA.

**Active Areas of Construction:** All areas subject to land surface disturbance activities related to the project including, but not limited to, project staging areas, immediate access areas and storage areas. All previously active areas of construction are considered active areas (unless temporarily defined as inactive areas) until final stabilization is complete.

**Active Treatment System (ATS):** A treatment technology that employs chemical coagulation, chemical flocculation, or electrocoagulation to reduce turbidity caused by fine suspended sediment, and/or to control pH levels. An active treatment system relies on enclosed computerized systems with pumps, filters, and real-time controls.

**Acute Toxicity:** Acute toxicity in water is caused by chemical stimuli that rapidly induce a negative effect on aquatic life; in aquatic toxicity tests, acute toxicity is demonstrated by an effect observed within 96 hours or less.

**Acute Toxicity Test:** Laboratory test in which an organism of interest (e.g., fathead minnow or rainbow trout) is placed in a water sample. By tracking the organism's survival, the lab can determine whether the sample water is toxic.

**Aquatic:** The water environment. Plants and animals that live in the water are referred to as being aquatic.

**Bacteria:** See pathogens.

**Beneficial Uses:** As defined in the California Water Code, beneficial uses of the waters of the State that may be protected against quality degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. See also COLD, MIGR, and SPWN.

**Best Management Practices (BMPs):** Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent, eliminate, or reduce the pollution of waters of the receiving waters. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

**Biofilter Bags:** Plastic mesh bag filled with 100% recycled wood product waste. They come in a variety of sizes and are used to detain flow and allowing a slow rate of discharge through the wood media.

**Cartridge Filter:** Cartridge filters provide a high degree of pollutant removal by utilizing a number of individual cartridges as part of a larger filtering unit. They are often used as a secondary or higher (polishing) level of treatment after a significant amount of sediment and other pollutants are removed.

**Catch Basin (Also known as Inlet):** Box-like underground concrete structure with openings in curbs and gutters designed to collect runoff from streets and pavement.

**Check Dam:** A small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams are used to reduce the effective slope of the channel and flow velocity, which allows sediment to settle out of suspension.

**Clay** A particle size class consisting of sediment particles less than 0.002 mm in diameter.

**Clean Water Act (CWA):** (33 U.S.C. 1251 et seq.) requirements of the NPDES program are defined under Sections 307, 402, 318 and 405 of the CWA.

**COLD:** Abbreviation for the Cold Freshwater Habitat Beneficial Use, which designates uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

**Compost:** Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste; it is organic and biodegradable and can be left on-site.

**Compost Berm:** A dike of compost with a trapezoidal cross-section used to intercept sheet flow when placed perpendicular to runoff flow.

**Compost Blanket:** A layer of compost applied at the appropriate thickness onto slopes and earth disturbed areas to prevent erosion, and in some cases, increase infiltration and/or establish vegetation. Provides organic matter and nutrients important for plant growth.

**Compost Sock:** Mesh sock containing compost used as a three-dimensional biodegradable filtering structure to intercept runoff where sheet flow occurs.

**Concrete Curing:** Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

**Concrete Finishing:** General term for methods used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Applications include sand blasting, shot blasting, grinding, or high-pressure water blasting.

**Construction Activity:** Includes clearing, grading, excavation, and contractor activities that result in soil disturbance.

**Denuded:** Land stripped of vegetation or land that has had its vegetation worn down due to the impacts from the elements or humans.

**Detention:** The temporary storage of stormwater to improve quality or reduce the volumetric flow rate of discharge or both.

**Dewatering:** The process of removing excess water in an excavation or impoundment by pumping or other mechanical means.

**Dewatering Bag:** See gravity bag filter.

**Dewatering Operations:** Practices that manage the discharge of pollutants when non-stormwater and/or stormwater must be removed from a work location to proceed with construction work or to provide vector control.

**Dewatering Tank:** A dewatering tank removes debris and sediment. Flow enters the tank through the top, passes through a fabric filter, and is discharged through the bottom of the tank. The filter separates the solids from the liquids.

**Discharge:** A release or flow of stormwater or other substance from a conveyance system or storage container. Broader – includes release to storm drains, etc.

**Discharge Location:** A common outlet from a construction site drainage area where stormwater, authorized non-stormwater, or dewatering discharge leaves the site or project boundary, or enters any on-site waters of the United States (e.g., a creek running through a site).

**Disking:** A mechanical method of roughening the upper layer of soil to reduce competing vegetation, improve water infiltration, and prepare for planting.

**Effluent Limitations:** Any numeric or narrative restriction imposed on quantities, discharge rates, and concentrations of pollutants which are discharged from point sources into waters of the United States, the waters of the contiguous zone, or the ocean.

**Erosion:** The process, by which soil particles are detached and transported by the actions of wind, water, or gravity.

**Erosion Control BMPs:** Are vegetation, such as grasses and wildflowers, and other materials, such as straw, fiber, stabilizing emulsion, protective blankets, rolled erosion control product, etc., placed to stabilize areas of disturbed soils, reduce loss of soil due to the action of water or wind, and prevent water pollution.

**Fiber Rolls:** A tight tubular roll made of straw, coir, or other biodegradable materials wrapped in netting which can be [photodegradable](#) or natural. Used along the contour or at the toe of a slope to intercept runoff, reduce flow velocity, and release the runoff as sheet flow, and provide some removal of sediment from the runoff.

**Fines:** Refers to soil particles (sediment) that fall within the clay or silt size fractions.

**Forecasted Precipitation Event:** Forecasted precipitation event is any weather pattern that is forecasted to have a 50 percent or greater chance of producing 0.5 inches of precipitation in a 24-hour period in the project area. The discharger shall obtain precipitation forecast information from the [National Weather Service Forecast Office](#) (e.g., by entering the zip code of the project's location at <https://forecast.weather.gov>). Precipitation events end when there are two sequential 24-hour periods with less than 0.25 inches of precipitation forecast for each period.

**(Construction) General Permit:** A National Pollutant Discharge Elimination System (NPDES) permit issued by the State Water Resources Control Board for the discharge of stormwater associated with construction activity from soil disturbance of one acre or more.

**Grading:** The cutting or filling of the land surface to a desired slope or elevation.

**Gravel Bag Berm:** Series of gravel-filled bags placed on a level contour to intercept sheet flow.



**Gravity Bag Filter:** A gravity bag filter, also referred to as a dewatering bag, is a square or rectangular bag made of non-woven geotextile fabric that collects gravel, sand, silt, and fines.

**Gross Pollutants:** Typically refers to visible pollutants such as trash, debris, and floatables, which may create an aesthetic “eye sore” in waterways, but may also include heavy metals, pesticides, and bacteria in stormwater. Gross pollutants also include plant debris (such as leaves and lawn-clippings), animal excrement, street litter, and other organic matter.

**Gully Erosion:** Erosion that occurs where the volume of runoff is concentrated, flowing water cuts deep into the soil bringing together separate rills into larger channels called gullies. Gully erosion acts like rill erosion on a larger scale.

**Hazardous Waste:** A waste or combination of wastes that, because of its quantity, concentration, or physical, chemical or infectious characteristics, may either cause or significantly contribute to an increase in mortality or an increase in serious irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appears on special U.S. EPA or State lists. Regulated under the federal Resource Conservation and Recovery Act and the California Health and Safety Code.

**Hydraulic Mulch:** Hydraulic mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

**Hydroseeding:** Typically consists of applying a mixture of a hydraulic mulch, seed, fertilizer, and stabilizing emulsion with a hydraulic mulcher, to temporarily protect exposed soils from erosion by water and wind.

**Illicit Discharges:** Any discharge to an MS4 or receiving water that is not in compliance with applicable laws and regulations, e.g., is not discharged pursuant to an NPDES permit or applicable exemption or waiver.

**Impervious Surface:** Ground cover that prevents the infiltration of water into the soil, such as pavement and buildings.

**Inactive Areas of Construction:** Areas of construction activity that have been disturbed but which are not currently being worked and are not scheduled to be re-disturbed for at least 14 days.

**Inactive Project:** A project where all construction activities (including passive treatment technology, active treatment systems, and/or active equipment), are fully stabilized and will be suspended for 30 days or more.

**Industrial General Permit:** The NPDES General Permit (No. CAS000001) issued by the State Water Resources Control Board for discharge of stormwater associated with industrial activity. Available online at [http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/industrial.shtml](http://www.waterboards.ca.gov/water_issues/programs/stormwater/industrial.shtml).

**Inlet:** An entrance into a ditch, storm drain, or other waterway.

**Integrated Pest Management (IPM):** An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism.

**Leaching:** Infiltration or percolation below the soil surface, which is perceived as a loss. Typically refers to fertilizers or salts being pushed below the plant rooting zone by rain or irrigation water.

**Legally Responsible Person (LRP):** The Legally Responsible Person is a representative of a permittee and signatory that is legally designated to sign, certify, and electronically submit any documents required by the General Permit, the State or Regional Water Board, or U.S. EPA.

**Linear Underground/Overhead Project (LUP):** Linear Underground/Overhead Projects (LUPs) include, but are not limited to, any conveyance, pipe, or pipeline for the transportation of any gaseous, liquid (including water and wastewater for domestic municipal services), liquescent, or slurry substance; any cable line or wire for the transmission of electrical energy; any cable line or wire for communications (e.g., telephone, telegraph, radio, or television messages); and associated ancillary facilities.

**MIGR:** Abbreviation for the Migration of Aquatic Organisms Beneficial Use, which designates uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

**Municipal Separate Storm Sewer System (MS4):** A conveyance or system of conveyances (including roads with drainage systems, municipal streets, [catch basins](#), curbs, gutters, ditches, man-made channels, or storm drains): (i) designed or used for collecting or conveying stormwater; (ii) which is not a combined sewer; and (iii) which is not part of a Publicly Owned Treatment Works (POTW) as defined at Title 40 of the Code of Federal Regulations (CFR) 122.2. A “Small MS4” is defined as an MS4 that is not a permitted MS4 under the Phase I regulations. This definition of a Small MS4 applies to MS4 operated within cities and counties as well as other public storm drain operators that have a system of storm sewers.

**Non-Point Source Pollution:** Pollution that originates from diffuse contamination that does not originate from a single discrete source and specifically does not come from a point source as defined by the CWA. Non-point source pollution can originate from aerial diffuse sources, agriculture, forests, and runoff that does not flow through an MS4, industrial, or construction operation subject to an NPDES permit.

**Non-stormwater Discharge:** Non-stormwater discharges are discharges that do not originate from precipitation events. They can include, but are not limited to, discharges of process water, air conditioner condensate, non-contact cooling water, vehicle wash water, sanitary wastes, concrete washout water, paint wash water, irrigation water, dust control over-wetting, or pipe testing water.

**Notice of Intent (NOI):** Part of the required Permit Registration Documents, which provides information on the owner, location, type of project, and certifies that the owner will comply with the conditions of the General Permit.

**Notice of Termination (NOT):** Formal notice to SWRCB submitted by owner/developer that a construction project is complete and the project has met the conditions to terminate the permit.

**NPDES Permit:** NPDES is an acronym for National Pollutant Discharge Elimination System. NPDES is the national program for administering and regulating Sections 307, 318, 402, and 405 of the CWA. In California, the State Water Resources Control Board (SWRCB) has issued a General Permit for stormwater discharges associated with construction activities (see Appendix A).

**Numeric Action Level (NAL):** A numeric action level (e.g., a pH range, turbidity value, or concentration) is a level that triggers a required evaluation of the effectiveness of best management practices implemented on the subject construction site, and the required implementation of additional corrective actions necessary to reduce the subject pollutant below the numeric action level. The numeric action level compliance location applies to each sample location and/or corresponding discharge location.

**Numeric Effluent Limitation (NEL):** A technology-based or water quality-based limit (e.g., pH range, turbidity value, or concentration) established for discharges covered under the General Permit. The numeric effluent limitation compliance location(s) applies to each sample and/or discharge location at the point of discharge from an active treatment system or construction site with TMDL requirements, as applicable.

**Nutrients:** Compounds necessary for plant and animal growth. In regards to water quality, the term usually refers to nitrogen and phosphorus compounds. These nutrients can result in excessive or accelerated growth of vegetation, such as algae, resulting in impaired use of water in lakes and other sources of water supply or recreational opportunities. For example, nutrients have led to a loss of water clarity in Lake Tahoe. In addition, excessive algae growth leads to oxygen depletion which can be fatal to fish and aquatic life. Also, un-ionized ammonia (one of the forms of nitrogen) can be toxic to fish.

**Oil and Grease:** Oil and grease includes a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. Sources of oil and grease include leakage, spills, cleaning and sloughing associated with vehicle and equipment engines and suspensions, leaking and breaks in hydraulic systems, restaurants and waste oil disposal.

**Organics:** Compounds that are carbon based. Often synthetic organic compounds (adhesives, cleaners, sealants, solvents, etc.) are widely applied and may be improperly stored and disposed.

**Outfall:** The end point where storm drains discharge water into a waterway.

**Passive Treatment:** Passive treatment is the application of natural or synthetic chemicals and products to reduce turbidity in discharges through coagulation and flocculation. Passive treatment does not rely on computerized, enclosed systems with pumps, filters, and real-time controls. Passive treatment may include pumps where they are necessary to move water around the construction site. Passive treatment products are available in a variety of forms and may be land-applied for soil stabilization (e.g., bonded fiber matrixes, hydromulches) or water-applied for sediment removal (e.g., liquid treatment chemicals, powders, slow-releasing solid blocks/socks). General Permit Attachment G applies to the use of water-applied passive

treatment products that remove suspended solids such as sediment from stormwater without using an active treatment system.

**Pathogens:** Refers to bacteria and viruses that cause disease. For separate storm drain systems, sources of these contaminants include animal excrement and sanitary sewer leaks and overflow. High levels of indicator bacteria in stormwater have led to the closure of beaches, lakes, and rivers to contact recreation such as swimming.

**Permit Registration Documents (PRDs):** A formal notice to SWRCB submitted by the owner of a construction site that said owner seeks coverage under the General Permit for discharges associated with construction activities.

**Pesticide:** Any substance used to eliminate pests. Pesticides include herbicides, fungicides, rodenticides, and insecticides.

**pH:** A measure of the acidic or basic nature of a solution. The typical pH scale ranges from 0 to 14, with pure water being neutral and having a pH of 7. Values above 7 are considered basic and pH values less than 7 are acidic, relative to how far they deviate from neutral (pH=7).

**(Construction) Phases:** The General Permit recognizes five distinct phases of construction activities: (1) Demolition and Pre-development Site Preparation Phase, (2) Grading and Land Development Phase, (3) Streets and Utilities Phase, (4) Vertical Construction Phase, and (5) Final Landscaping and Site Stabilization Phase. Each phase has activities that can result in different water quality effects from different water quality pollutants and some General Permit requirements are tailored to the construction phase.

**Photodegradable:** A material that breaks down or degrades in sunlight.

**Planning Watershed:** Planning watershed was defined by the Calwater watershed classification system as a watershed ranging in size from approximately 3,000 to 10,000 acres. The Calwater watershed classification system has since been merged with the national Watershed Boundary Dataset (WBD). For the purposes of this permit, Calwater planning watersheds are assumed to be roughly equivalent to the WBD's Hydrologic Unit Code, 12 digit subwatersheds (HUC-12). See:

[http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/docs/constpermits/guidance/receivingwaterrisk.pdf](http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/guidance/receivingwaterrisk.pdf).

**Point Source:** Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

**Pollutant:** Generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

**Pollution Prevention (P2):** Practices and actions that reduce or eliminate the generation of pollutants.

**Polyacrylamide (PAM):** Substance available in a variety of forms used to aggregate soil particles allowing them to settle out of suspension.

**Precipitation:** Any form of rain or snow.

**Pressurized Bag Filter:** A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

**Pretreatment:** Treatment of waste stream before it is discharged to a collection system.

**Qualified SWPPP Developer (QSD):** Individual who is a qualified stormwater professional authorized by the discharger to develop and revise SWPPPs. Effective September 1, 2023, a QSD shall have one of the following credentials:

- a. A California registered professional civil engineer; or
- b. A California registered professional geologist or engineering geologist; or
- c. A California registered landscape architect; or
- d. A professional hydrologist registered through the American Institute of Hydrology; or
- e. A Certified Professional in Erosion and Sediment Control (CPESC) registered through EnviroCert International, Inc.; or
- f. A Certified Professional in Storm Water Quality (CPSWQ) registered through EnviroCert International, Inc.; or
- g. Any prerequisite course approved by the State Water Board's Division of Water Quality Deputy Director in accordance with General Permit Section V.G.

Effective September 2, 2011, a QSD shall have attended an SWRCB-sponsored or approved QSD training course.

**Qualified SWPPP Practitioner (QSP):** Individual who is a qualified stormwater professional authorized by the discharger to conduct non-stormwater and stormwater visual observations, sampling, and implementation of all elements of the SWPPP. Effective September 1, 2023, a QSP shall have attended an SWRCB-sponsored or approved QSP training course and shall be either a QSD or have one of the following credentials:

- a. A Certified Erosion, Sediment and Storm Water Inspector (CESSWI) registered through EnviroCert International, Inc.; or
- b. A Certified Inspector of Sediment and Erosion Control (CISEC) registered through Certified Inspector of Sediment and Erosion Control, Inc.; or
- c. A Construction Management degree from an accredited 4-year institution that includes coursework that covers the underlying principles of erosion and sediment control and practices of reducing pollution in stormwater; or
- d. Any prerequisite course approved by the State Water Board's Division of Water Quality Deputy Director in accordance with General Permit Section V.H.

**Qualified SWPPP Practitioner Delegate (QSP Delegate):** An individual assigned responsibility by the QSP for the implementation of specific elements of the SWPPP who has completed the required foundational and site-specific training provided by the QSP.

**Qualifying Precipitation Event (QPE):** Qualifying precipitation event is any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a

**Quantitative Precipitation Forecast (QPF)** of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast.

**Quantitative Precipitation Forecast (QPF):** Quantitative Precipitation Forecast is the forecast that includes precipitation and snow accumulation measurements. This information can be obtained from the NOAA Forecast.

**Receiving Water:** A river, lake, stream, estuary, bay, or ocean into which runoff is discharged.

**Receiving Water Monitoring Trigger:** Thresholds for particular effluent water quality measurements that trigger receiving water monitoring for a subset of construction projects. The General Permit includes receiving water triggers for pH and turbidity.

**Responsible Discharger:** Responsible dischargers are dischargers who:

- a. Discharge stormwater and authorized non-stormwater directly, or through a municipal separate sewer system (MS4) or other conveyance, to impaired water bodies or watersheds identified in a U.S. EPA-approved TMDL with a waste load allocation assigned to construction stormwater sources; and
- b. Have identified, through the site-specific pollutant source assessment, that one or more pollutants specific to the TMDL are present on-site with the potential to enter construction stormwater discharges.

**Retention:** The storage of stormwater to prevent it from leaving the development site.

**Revised Universal Soil Loss Equation (RUSLE):** A formula for determining soil loss in tons per acre according to different site specific variables. The equation is written as follows:

$$A=(R)(K)(LS)(C)(P)$$

Where:

R = rainfall-runoff erosivity factor

K = soil erodibility factor

LS = length-slope factor

C = cover factor

P = management operations and support practices

**Rill Erosion:** Rills are channels small enough to be smoothed over by normal tillage. Rill erosion takes place when water concentrates in these small channels and carries sediment in the water flow.

**Riparian:** Refers to the habitat located adjacent to rivers or streams.

**Rolled Erosion Control Products (RECPs):** These products, also known as geotextiles and mats, can be made of natural or synthetic materials or a combination of the two. RECPs are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface.



**Roughening:** Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces.

**Runoff:** Water originating from rainfall, melted snow, and other sources (e.g., sprinkler irrigation) that flows over the land surface to drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands.

**Run-on:** Discharges that originate offsite and flow onto the property of a separate project site.

**Sand:** A soil particle between 0.05 and 2.0 mm in diameter.

**Sandbag Barrier:** Series of sand-filled bags placed on a level contour to intercept or divert sheet flows of water.

**Sand Media Particulate Filter:** Water is treated by passing it through canisters filled with sand media. Generally, sand filters provide a final level of treatment. They are often used as a secondary or higher level of treatment after a significant amount of sediment and other pollutants have been removed using other methods.

**Scour:** The erosive and digging action in a watercourse caused by flowing water.

**Secondary Containment:** A device or control measure in addition to the primary containment that is used to stop a discharge of pollutants or hazardous material from leaving a specified area.

**Sedimentation:** The process of depositing soil particles, clays, sands, or other sediments that were picked up by runoff.

**Sediment:** Sediment is solid particulate matter, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

**Sediment Basin:** A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging.

**Sediment Control:** Sediment controls are treatment control practices that trap soil particles after erosion by rain, flowing water, or wind. They include those practices that intercept and slow or detain the flow of stormwater to allow sediment to settle and be trapped (e.g., silt fence, sediment basin, fiber rolls, etc.). Sediment control measures are usually passive systems that rely on filtering or settling the particles out of the water or wind that is transporting them.

**Sediment Transport Capacity:** The capability of a channel to move sediment, this varies under different flow conditions.

**Sediment Trap:** A temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging.

**Sheet Erosion:** Sheet erosion is relatively uniform erosion from the entire soil surface.

**Significant Materials:** Includes, but not limited to, raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw

materials used in food processing or production; hazardous substances designed under Section 101(14) of CERCLA; any chemical the facility is required to report pursuant to Section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with stormwater discharges.

**Significant Quantities:** The volume, concentrations, or mass of a pollutant in stormwater discharge that can cause or threaten to cause pollution, contamination, or nuisance that adversely impact human health or the environment and cause or contribute to a violation of any applicable water quality standards for receiving water.

**Silt:** A soil particle size class consisting of particles between 0.05 and 0.002 mm in diameter. These particles are smaller than sand and larger than clay.

**Silt Fence:** A silt fence is used to detain sediment-laden water, promoting sedimentation behind the fence. Silt fences are made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support.

**Soil Binder:** Material applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites. Soil binders are typically applied to disturbed areas requiring short term temporary protection.

**Soil Preparation:** Steps taken to prepare soil for planting or the installation of a BMP. Soil preparation may include tilling, raking, or the addition of a soil amendment.

**Source Control BMPs:** Operational practices that reduce potential pollutants at the source.

**Source Reduction (also source control):** The technique of stopping and/or reducing pollutants at their point of generation so that they do not come into contact with stormwater.

**SPWN:** Abbreviation for the Spawning, Reproduction, and/or Early Development Beneficial Use, which designates uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

**Stockpile Management:** Procedures and practices that are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, soil amendments, sand, paving materials such as Portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate subbase or pre-mixed aggregate, asphalt minder (so called “cold mix” asphalt), and pressure treated wood.

**Storm Drains:** Above- and below-ground structures for transporting stormwater to streams or [outfalls](#) for flood control purposes.

**Stormwater:** Stormwater is rain, snowmelt, or any other liquid or solid precipitation that may result in runoff, and drainage from a site. Stormwater is that portion of precipitation that flows across a surface to the storm drain system or receiving waters.

**Stormwater Discharge Associated with Industrial Activity:** Discharge from any conveyance which is used for collecting and conveying stormwater from an area that is directly related to manufacturing, processing, or raw materials storage activities at an industrial plant.

**Stormwater Pollution Prevention Plan (SWPPP):** A written plan that documents the series of phases and activities that, first, characterizes your site, and then prompts you to select and carry out actions which prevent the pollution of stormwater discharges.



**Straw Mulch:** Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper, or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

**Temporary Batch Plant:** During the construction of large structures or in remote locations, a temporary batch plant may be necessary to manufacture Portland Cement Concrete (PCC) or [AC](#). Temporary batch plant facilities typically consist of silos containing fly ash, lime, and cement; heated tanks of liquid asphalt; sand and gravel material storage areas; mixing equipment; above ground storage tanks containing concrete additives and water; and designated areas for sand and gravel truck unloading, concrete truck loading, and concrete truck washout.

**Temporary Silt Dike:** Pre-manufactured device that is installed for semi-permanent drainage and sediment control on the perimeter of disturbed sites or stockpiles of materials or as check dams within channels.

**Total Maximum Daily Load (TMDL):** A TMDL is the sum of the maximum amount of a pollutant that a waterbody can receive per day and still meet state water quality standards. It is the sum of the individual Waste Load Allocations (WLAs) for point sources, the load allocations for nonpoint and natural background sources, and the margin of safety.

**Toxicity:** Adverse responses of organisms to chemicals or physical agents ranging from mortality to physiological responses such as impaired reproduction or growth anomalies.

**Tracking Control:** Tracking control refers to methods of preventing or reducing the tracking of sediment off-site by vehicles leaving the construction area.

**Traditional Construction Project:** Most construction projects, including but not limited to commercial, residential, industrial, institutional, and highway construction project. Does not include those projects defined as LUPs.

**Trash:** All improperly discarded solid material from any production, manufacturing, or processing operation including, but not limited to, products, product packaging, or containers constructed of plastic, steel, aluminum, glass, paper, or other synthetic or natural materials.

**Treatment Control BMPs:** Treatment methods to remove pollutants from stormwater.

**Turbidity:** The optical condition and cloudiness of water caused by suspended or dissolved particles or colloids. Turbidity is quantified by the degree to which light traveling through a water column is scattered by the suspended organic and inorganic particles it contains. The turbidity test is reported in Nephelometric Turbidity Units (NTU) or Jackson Turbidity Units (JTU) with a calibrated turbidity meter.

**Urban Runoff:** Stormwater from city streets and adjacent domestic or commercial properties that carries pollutants of various kinds into the sewer systems and receiving waters.

**Vector:** Organism that spreads disease (e.g., mosquitos and rodents).

**Vegetation:** Living plant matter.

**Virus:** See pathogens.

**Wadable Stream:** Streams that can be sampled by field crews wearing chest waders (generally less than 0.5 m-1.0 meters deep)

**Waste Management:** Source control management practices that prevent pollution by limiting or reducing potential pollutants at their source, before they come into contact with stormwater. Practices under this category can be thought of as “good housekeeping” and include procedural and structural BMPs for handling, storing, and disposing of wastes generated by a construction project.

**Weir Tank:** A weir tank separates water and waste by using weirs. The configuration of the weirs (over and under weirs) maximizes the residence time in the tank and determines the waste to be removed from the water, such as oil, grease, and sediments.

**Wetland:** An area of land that has water-saturated soils for long periods of time and water loving vegetation. Wetlands are typically flooded for part of the year, forming a transitional area between aquatic and terrestrial environments.

**Wind Erosion Control:** Methods used to minimize wind erosion. Controls consist of applying water or other dust palliatives to prevent or alleviate dust nuisance.

## 5.2 List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
ADL	Aerially Deposited Lead
AIMP	Impervious Area
AINF	Infiltration Area
ANSI	American National Standards Institute
APCD	Air Pollution Control District
APHA	American Public Health Association
APWA	American Public Works Association
AQMD	Air Quality Management District
ARB	Air Resources Board
ARS	Agricultural Research Service
ASTM	American Society for Testing Materials
ATS	Active Treatment System
AWWA	American Water Works Association
BAT	Best Available Technology (economically available)
BCT	Best Conventional Technology (pollution control)
BFM	Bonded Fiber Matrix
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
CA	Contractor Activities
CAL-OSHA	California Division of Occupational Safety and Health Administration
CASQA	California Stormwater Quality Association
CCR	California Code of Regulations
CCS	Cellular Confinement System
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CESSWI	Certified Erosion, Sediment, and Storm Water Inspector
CFR	Code of Federal Regulations
CISEC	Certified Inspector of Erosion and Sediment Control
COC	Chain of Custody

COE	United States Army Corps of Engineers, also known as, USACE
CPESC	Certified Professional in Erosion and Sediment Control
CPI	Coalescing Plate Interceptor
CPSWQ	Certified Professional in Storm Water Quality
CSMP	Construction Site Monitoring Program
CWA	Clean Water Act (Federal Water Pollution Control Act of 1972 as amended in 1987)
DCIA	Directly Connected Impervious Area
DFG	(California) Department of Fish and Game
DG	Decomposed Granite
DHS	Department of Health Services
DTSC	California Department of Toxic Substances Control
EC	Erosion Control
EEC	Effect Effluent Concentration
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELG	Effluent Limitation Guideline
ELAP	Environmental Laboratory Accreditation Program
EMC	Event Mean Concentration
EOS	Equivalent Opening Size
EPA	Environmental Protection Agency
ESA	Environmentally Sensitive Area
ESC	Erosion and Sediment Control
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIS	Geographical Information System
Hazmat	Hazardous Material
HCM	Hydraulic Compost Matrix
HDPE	High-Density Polyethylene
HM	Hydraulic Matrix
HSG	Hydrologic Soil Groups
IPM	Integrated Pest Management

LOEC	Lowest Observed Effect Concentration
LOI	Loss-On-Ignition
LUP	Linear Underground/Overhead Project
LRP	Legally Responsible Person
MATC	Maximum Allowable Threshold Concentration
MBAS	Methylene Blue Activated Substances
MBFM	Mechanically-Bonded Fiber Matrix
MEP	Maximum Extent Practicable
MDL	Method Detection Limit
MLSC	Manufactured Linear Sediment Control
MS4	Municipal Separate Storm Sewer System
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MSRP	Monitoring, Sampling & Reporting Plan
NAL	Numeric Action Level
NEL	Numeric Effluent Limitation
NELAP	National Environmental Laboratory Accreditation Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOEC	No Observed Effect Concentration
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NS	Non-stormwater Management
NSF	National Science Foundation
NTU	Nephelometric Turbidity Unit
NURP	National Urban Runoff Program
O&G	Oil and Grease

O&M	Operations and Maintenance
OSDS	On-site Disposal System
OSHA	Occupational Safety and Health Administration
P2	Pollution Prevention
PAHs	Poly-Aromatic Hydrocarbons
PAM	Polyacrylamide
PCBs	Polychlorinated Biphenyls
PCC	Portland Cement Concrete
PH	Professional Hydrologist
PLS	Pure Live Seed
PPT	Pollution Prevention Team
PoP	Probability of Precipitation
POTW	Publicly Owned Treatment Works
PRD	Permit Registration Document
PSD	Particle Size Distribution
PTS	Passive Treatment System
QA	Quality Assurance
QC	Quality Control
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
QPE	Qualifying Precipitation Event
QPF	Quantitative Precipitation Forecast
RCRA	Resource Conservation and Recovery Act
RECP	Rolled Erosion Control Product
RUSLE	Revised Universal Soil Loss Equation
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCP	Scientific Collecting Permit
SE	Sediment Control
SIC	Standard Industrial Classification
SFM	Stabilized Fiber Matrix

SM	Standard Mulch
SMARTS	Storm Water Multiple Application and Report Tracking System
SPCC	Spill Prevention Control and Countermeasure
SSC	Suspended Sediment Concentration
SUSMP	Standard Urban Stormwater Mitigation Plan
SVOC	Semi-Volatile Organic Compound
SWAMP	Surface Water Ambient Monitoring Program
SWMP	Stormwater Management Program
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TC	Tracking Control
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TMECC	Test Methods for the Examination of Composting and Compost
TOC	Total Organic Carbon
TRM	Turf Reinforcement Mat
TSP	Trisodium phosphate
TSS	Total Suspended Solids
UFC	Uniform Fire Code
USACE	United States Army Corps of Engineers, also known as, COE
USC	United States Code
USCC	United States Compost Council
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
UV	Ultraviolet
VOCs	Volatile Organic Compounds
WDID	Waste Discharge Identification (Number)
WDR	Water Discharge Requirement
WE	Wind Erosion Control
WEF	Water Environment Federation
WET	Whole Effluent Toxicity
WM	Waste Management

## **Appendix H:     BMP Inspection Form**

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## BMP INSPECTION REPORT

Date and Time of Inspection:			Date Report Written:		
Inspection Type: (Circle one)	<i>Weekly Complete Parts I,II,III and VII</i>	<i>Pre-Qualifying Precipitation Event (QPE) Complete Parts I,II,III,IV and VII</i>	<i>During QPE Complete Parts I, II, III, V, and VII</i>	<i>Post-QPE Complete Parts I,II,III,VI and VII</i>	<i>Inactive Project Complete Parts I,II,III and VII</i>
<b>Part I. General Information</b>					
Site Information					
Construction Site Name: CCC Sports Complex					
Construction stage and completed activities:				Approximate area of site that is exposed:	
Photos Taken: (Circle one)	Yes	No	Photo Reference IDs:		
Weather					
Estimate storm beginning: (date and time)			Estimate storm duration: (hours)		
Estimate time since last storm: (days or hours)			Rain gauge reading and location: (in)		
<p>Is a "Qualifying Precipitation Event" predicted or did one occur (i.e., any weather pattern with a 50% chance of 0.5" or more within a 24-hr period when 0.5" has been forecast and continues on subsequent 24-hour periods when 0.25" of precipitation or more is forecast)? (Y/N)</p> <p>If yes, summarize forecast:</p>					
Exception Documentation (explanation required if inspection could not be conducted). Visual inspections are not required outside of business hours or during dangerous weather conditions such as electrical storms, flooding, and high winds above 40 miles per hour.					
Inspector Information					
Inspector Name:				Inspector Title:	
Inspector Certification:				Date:	
<b>Part II. BMP Observations. Describe deficiencies in Part III.</b>					

Minimum BMPs for Risk Level _____ Sites	Adequately designed, implemented and effective (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
<b>Good Housekeeping for Construction Materials</b>			
Inventory of products (excluding materials designed to be outdoors)			
Stockpiled construction materials not actively in use are covered and bermed			
All chemicals are stored in watertight containers with appropriate secondary containment, or in a completely enclosed storage shed			
Construction materials are minimally exposed to precipitation			
BMPs preventing the off-site tracking of materials are implemented and properly effective			
<b>Good Housekeeping for Waste Management</b>			
Wash/rinse water and materials are prevented from being disposed into the storm drain system			
Portable toilets are contained to prevent discharges of waste			
Sanitation facilities are clean and with no apparent for leaks and spills			
Equipment is in place to cover waste disposal containers at the end of business day and during rain events			
Discharges from waste disposal containers are prevented from discharging to the storm drain system / receiving water			
Stockpiled waste material is securely protected from wind and rain if not actively in use			
Procedures are in place for addressing hazardous and non-hazardous spills			
Appropriate spill response personnel are assigned and trained			
Equipment and materials for cleanup of spills is available onsite			
Washout areas (e.g., concrete) are contained appropriately to prevent discharge or infiltration into the underlying soil			
<b>Good Housekeeping for Vehicle Storage and Maintenance</b>			
Measures are in place to prevent oil, grease, or fuel from leaking into the ground, storm drains, or surface waters			
All equipment or vehicles are fueled, maintained, and stored in a designated area with appropriate BMPs			
Vehicle and equipment leaks are cleaned immediately and disposed of properly			

<b>Part II. BMP Observations Continued. Describe deficiencies in Part III.</b>			
Minimum BMPs for Risk Level _____ Sites	Adequately designed,	Action Required (yes/no)	Action Implemented (Date)

	implemented and effective (yes, no, N/A)		
<b>Good Housekeeping for Landscape Materials</b>			
Stockpiled landscape materials such as mulches and topsoil are contained and covered when not actively in use			
Erodible landscape material has not been applied 2 days before a forecasted rain event or during an event			
Erodible landscape materials are applied at quantities and rates in accordance with manufacturer recommendations			
Bagged erodible landscape materials are stored on pallets and covered			
<b>Good Housekeeping for Air Deposition of Site Materials</b>			
Good housekeeping measures are implemented onsite to control the air deposition of site materials and from site operations			
<b>Non-Stormwater Management</b>			
Non-Stormwater discharges are properly controlled			
Vehicles are washed in a manner to prevent non-stormwater discharges to surface waters or drainage systems			
Streets are cleaned in a manner to prevent unauthorized non-stormwater discharges to surface waters or drainage systems.			
<b>Erosion Controls</b>			
Wind erosion controls are effectively implemented			
Effective soil cover is provided for disturbed areas inactive (i.e., not scheduled to be disturbed for 14 days) as well as finished slopes, open space, utility backfill, and completed lots			
The use of plastic materials is limited in cases when a more sustainable, environmentally friendly alternative exists.			
<b>Sediment Controls</b>			
Perimeter controls are established and effective at controlling erosion and sediment discharges from the site			
Entrances and exits are stabilized to control erosion and sediment discharges from the site			
Sediment basins are properly maintained			
Inspect immediate access roads prior to forecasted precipitation			
Linear sediment control along toe of slope, face of slope and at grade breaks (Risk Level 2 & 3 Only)			
Limit construction activity to and from site to entrances and exits that employ effective controls to prevent offsite tracking (Risk Level 2 & 3 Only)			
Ensure all storm, drain inlets and perimeter controls, runoff control BMPs and pollutants controls at entrances and exits are maintained and protected from activities that reduce their effectiveness (Risk Level 2 & 3 Only)			
<b>Run-On and Run-Off Controls</b>			

Run-on to the site is effectively managed and directed away from all disturbed areas.			
<b>Other</b>			
Are the project SWPPP and BMP plan up to date, available onsite and being properly implemented?			
Is the posting of the project's unique WDID number, waiver identification number, and site and project contact information publicly accessible?			

<b>Part III. Descriptions of BMP Deficiencies</b>		
<b>Deficiency</b>	<b>Repairs Implemented:</b> <b>Note - Repairs must begin within 72 hours of identification and, complete repairs as soon as possible.</b>	
	<b>Start Date</b>	<b>Action</b>
1.		
2.		
3.		
4.		

<b>Part IV. Additional Pre-QPE Observations. Note the presence or absence of floating and suspended materials, sheen, discoloration, turbidity, odors, and source(s) of pollutants(s).</b>	
	Yes, No, N/A
Do stormwater storage and containment areas have adequate freeboard? If no, complete Part III.	
Are drainage areas free of spills, leaks, or uncontrolled pollutant sources? If no, complete Part VII and describe below.	
Notes:	
Are stormwater storage and containment areas free of leaks? If no, complete Parts III and/or VII and describe below.	
Notes:	

<b>Part V. Additional During-QPE Observations. If BMPs cannot be inspected during inclement weather, list the results of visual inspections at all relevant outfalls, discharge points, and downstream locations. Note odors or visible sheen on the surface of discharges. Complete Part VII (Corrective Actions) as needed.</b>
Outfall, Discharge Point, or Other Downstream Location

Location	Description
Location	Description
Location	Description
Location	Description

**Part VI. Additional Post-QPE Observations.** Visually observe (inspect) stormwater discharges at all discharge locations within 96 hours after each qualifying precipitation event, and observe (inspect) the discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying precipitation event producing precipitation of ½ inch or more at the time of discharge. Complete Part VII (Corrective Actions) as needed.

Discharge Location, Storage or Containment Area	Visual Observation

**Part VII. Additional Corrective Actions Required.** Identify additional corrective actions not included with BMP Deficiencies (Part III) above. Note if SWPPP change is required.

Required Actions	Implementation Date

## **Appendix I: Training Forms**

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# Contractor Personnel Training Log

## Stormwater Management Training Log and Documentation

Project Name: CCC Sports Complex

WDID#: TBD

Stormwater Management Topic: (check as appropriate)

- ☐ Good Housekeeping BMPs      ☐ Erosion Control BMPs  
☐ Sediment Control BMPs      ☐ Tracking Control  
☐ Non-Stormwater Management BMPs      ☐ Waste Management & Pollution Control BMPs  
☐ BMP Implementation Activities      ☐ Advanced BMPs  
☐ Identification of QSPs and QSP Delegates

Training Objective: \_\_\_\_\_

Date: \_\_\_\_\_

Instructor: \_\_\_\_\_

Training Length (hours): \_\_\_\_\_

### Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

# QSP Delegate Training Log

## Stormwater Management Training Log and Documentation

Project Name: CCC Sports Complex

WDID#: TBD

QSP Delegate Name: \_\_\_\_\_

### Delegated Responsibilities:

- ☐ Stormwater Visual Inspections
- ☐ Sampling
- ☐ BMP Inspections
- ☐ BMP Maintenance and Repair

### Foundational Training

Topic	Date Completed	QSP Trainer
<input type="checkbox"/> Roles and Responsibilities		
<input type="checkbox"/> Forecast Information		
<input type="checkbox"/> Documentation and Reporting Procedures		

### Site-Specific Training

Topic	Date Completed	QSP Trainer
<input type="checkbox"/> Visual Inspections		
<input type="checkbox"/> Sample Collection Procedures		
<input type="checkbox"/> Sample Reporting Procedures		
<input type="checkbox"/> BMP Implementation		

As needed, attach proof of external training (e.g., course completion certificates, credentials for the QSP Delegate).



## **Appendix J: Responsible Parties**

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## Identification of QSP and QSP Delegates

Project Name: CCC Sports Complex

WDID#: TBD

The following are QSPs and QSP Delegates associated with this project

Name of Personnel <sup>(1)</sup>	QSP Number, or state "Delegate"	Company	Date

(1) If additional QSPs or QSP Delegates are required on the job site add additional lines

## **Appendix K: Contractors and Subcontractors**

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### **Prime Contractor/Construction Management Firm:**

Contractor Name:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

### **Sub-Contractors:**

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
----------------------	--

Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

## **Appendix L: Post-Construction Calculations/ Demonstration**

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## **Appendix M: Weather Reports**

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The discharger must obtain the precipitation forecast information from the National Weather Service Forecast Office (<http://forecast.weather.gov> ). A printed copy with the date and time of printing should be retained in this Appendix.

## **Appendix N:      Monitoring Records**

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Place completed BMP Inspection Forms, photographic documentation, Effluent Sampling, Receiving Water, and Dewatering Field Logs, Monitoring Exceptions, NAL Exceedance Reports, and Receiving Water Monitoring Trigger Exceptions in this appendix.

## **Appendix O: Storm Event/Dewatering Monitoring Forms**

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Rain Gauge Log Sheet				
Construction Site Name:				
WDID #:				
Date (mm/dd/yy)	Time (24-hr)	Initials	Rainfall Depth (Inches)	Notes:

**Risk Level 1, 2, 3**  
**Visual Inspection Field Log Sheet**

Date and Time of Inspection:				Report Date:	
Inspection Type:	<input type="checkbox"/> Weekly	<input type="checkbox"/> Pre Qualifying Precipitation Event (QPE)	<input type="checkbox"/> During QPE	<input type="checkbox"/> Post QPE	<input type="checkbox"/> Dewatering Discharge
<b>Site Information</b>					
Construction Site Name:					
Construction stage and completed activities:				Approximate area of exposed site:	
<b>Weather and Observations</b>					
Date Rain Predicted to Occur:			Predicted % chance of precipitation (PoP): Predicted quantity of precipitation (QPF):		
Estimate storm beginning:  _____	Estimate storm duration: _____	Estimate time since last storm: _____	Rain gauge reading: _____		
(date and time)	(hours)	(days or hours)	align="center">(inches)		
Observations: If yes identify location					
Odors	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Floating material	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Suspended Material	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Sheen	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Discolorations	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
Turbidity	Yes <input type="checkbox"/>	No <input type="checkbox"/>			
<b>Site Inspections</b>					
<b>Outfalls or BMPs Evaluated</b>			<b>Deficiencies Noted</b>		
(add additional sheets or attached detailed BMP Inspection Checklists)					
Photos Taken:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Photo Reference IDs:		
<b>Corrective Actions Identified (note if SWPPP change is needed)</b>					
<b>Inspector Information</b>					
Inspector Name:			Inspector Title:		
Signature:					Date:

**Risk Level 1, 2, 3  
Effluent Sampling Field Log Sheets**

Construction Site Name:	Date:	Time Start:
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Sampler:
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Sampling Event Type:	<input type="checkbox"/> Stormwater	<input type="checkbox"/> Dewatering Discharge	<input type="checkbox"/> Non-visible pollutant
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**Field Meter Calibration**

pH Meter ID No./Desc.:	Turbidity Meter ID No./Desc.:
Calibration Date/Time:	Calibration Date/Time:

**Field pH and Turbidity Measurements**

Discharge Location Description	pH	Turbidity	Time

**Grab Samples Collected**

Discharge Location Description	Sample Type	Time

**Additional Sampling Notes:**

Additional Sampling Notes:
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Time End:
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<b>Risk Level 3</b> <b>Receiving Water Sampling Field Log Sheets</b>			
Construction Site Name:		Date:	Time Start:
Sampler:			
Receiving Water Description and Observations			
Receiving Water Name/ID:			
Observations:			
Odors	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Floating material	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Suspended Material	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Sheen	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Discolorations	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Turbidity	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Field Meter Calibration			
pH Meter ID No./Desc.:		Turbidity Meter ID No./Desc.:	
Calibration Date/Time:		Calibration Date/Time:	
Field pH and Turbidity Measurements			
Upstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
Downstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
Additional Sampling Notes:			
Time End:			

NAL Exceedance Evaluation Summary Report		Page ___ of ___
Project Name		
Project WDID		
Project Location		
Date of Exceedance		
Type of Exceedance	NAL <input type="checkbox"/> pH <input type="checkbox"/> Turbidity <input type="checkbox"/> Other (specify) _____	
Measurement or Analytical Method	<input type="checkbox"/> Field meter (Sensitivity: _____) <input type="checkbox"/> Lab method (specify) _____ (Minimum Level: _____) (MDL: _____)	
Calculated Daily Average	<input type="checkbox"/> pH _____ pH units <input type="checkbox"/> Turbidity _____ NTU	
Rain Gauge Measurement	_____ inches	
Visual Observations on Day of Exceedance		

NAL Exceedance Evaluation Summary Report		Page ____ of ____
<b>Description of BMPs in Place at Time of Event</b>		
<b>Initial Assessment of Cause</b>		
<b>Corrective Actions Taken (deployed after exceedance)</b>		
<b>Additional Corrective Actions Proposed</b>		
<b>Report Completed By</b>	<div></div> <div>(Print Name, Title)</div>	
<b>Signature</b>	<div></div>	

**CHAIN-OF-CUSTODY****DATE:****Lab ID:**

DESTINATION LAB:							REQUESTED ANALYSIS				Notes:	
ATTN:  ADDRESS:  Office Phone: Cell Phone:												
SAMPLED BY:												
Contact:												
Project Name												
Client Sample ID	Sample Date	Sample Time	Sample Matrix	Container								
				#	Type	Pres.						
SENDER COMMENTS:							RELINQUISHED BY					
							Signature: Print: Company: Date: TIME:					
LABORATORY COMMENTS:												
							Signature: Print: Company: Date: TIME:					

## **Appendix P:      Field Meter Instructions**

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## **Appendix Q: Supplemental Information**

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# MEMORANDUM

To: SWRCB  
From: Gabriel Ledesma

Date: 09/04/2024  
WDID#.: TBD

Subject: CCC Sports Complex Post-Construction Compliance Demonstration

This memo is to demonstrate compliance with the FMFCD Phase I MS4 post-construction requirements for the CCC Sports Complex project (Project). Attached is FMFCD's "Guide to Determining if the 'Post-Development Standards Technical Manual' Applies to Your Project", which states that projects within drainage areas that do not discharge to the San Joaquin River (and instead discharge to the Regional Stormwater Management Basin System) are not subject to post-development standards. The Project is located in the FMFCD drainage area of Basin "R", which is a component of the Regional Stormwater Management Basin System; therefore, post-development standards are not required for the Project.

Thank You,

Gabriel Ledesma





## Guide to Determining if the 'Post-Development Standards Technical Manual' Applies to Your Project

### What is the Post-Development Standards Technical Manual?

Based on the Clean Water Act and Municipal Separate Storm Sewer System (MS4) permit, the Central Valley Regional Water Quality Control Board has required that the Fresno Metropolitan Flood Control District, along with the County of Fresno and Cities of Fresno and Clovis, create new stormwater quality standards and requirements for certain new development and redevelopment projects, dubbed Priority Projects. The new standards imposed upon Priority Projects are contained in the Post-Development Standards Technical Manual.

### What projects does this apply to?

A project is a Priority Project, and therefore subject to the Manual, if it meets one or more of the following criteria, and discharges to the San Joaquin River or does not discharge to a District stormwater management basin:

- Home subdivisions of 10 housing units or more;
- Commercial developments greater than 100,000 square feet;
- Automotive repair shops;
- Restaurants;
- Parking lots 5,000 square feet or greater **or** 25 or more parking spaces;
- Streets and roads;
- Retail gasoline outlets (RGOs); and
- Significant redevelopment projects (developments that result in creation or addition of at least 5,000 square feet of impervious surface on an already developed site).

Still unsure? See the map outlining Priority Project areas, or call the District at (559) 456-3292.

### What types of standards are required?

The standards required by the Manual are: bio-retention/infiltration of landscape areas, disconnected hydrologic flow paths, reduced impervious areas, functional landscaping, and grading to maintain natural hydrologic functions that existed prior to development, such as interception shallow surface storage, infiltration, evapotranspiration, and groundwater recharge.



### What is required in a submittal?

At minimum, a submittal will contain:

- A site plan, landscape plan, and grading plan;
- An Operational Statement containing:
  - The criteria under which the project qualifies as a priority project
  - A detailed site assessment identifying design considerations
  - A list of proposed stormwater and source control BMPs, with discussion as why they have been chosen over other options, how they are designed, and how they will be implemented;
- A calculation of Stormwater Quality Design Volume (SWQDV) or Stormwater Quality Design Flow (SWQDF); and
- A maintenance plan agreement.

*(continued on reverse side)*

## Why does all of this matter?

The Manual is intended to protect and improve water quality from the development of certain use classifications, in specific geographic areas, that have a higher potential for stormwater and non-stormwater discharge impacts. If your project is required to follow the Manual, it is in your best interest to plan for and incorporate the standards laid out in the Manual as soon as possible—rather than wait until they appear

in your Notice of Requirements (NOR).

## Next Steps

If you have determined that your project is subject to the Post-Development Standards Technical Manual, please go to <http://www.fresnofloodcontrol.org/wp-content/uploads/2014/11/Post-Development-Standards-Technical-Manual.pdf> to view the Manual in its entirety.

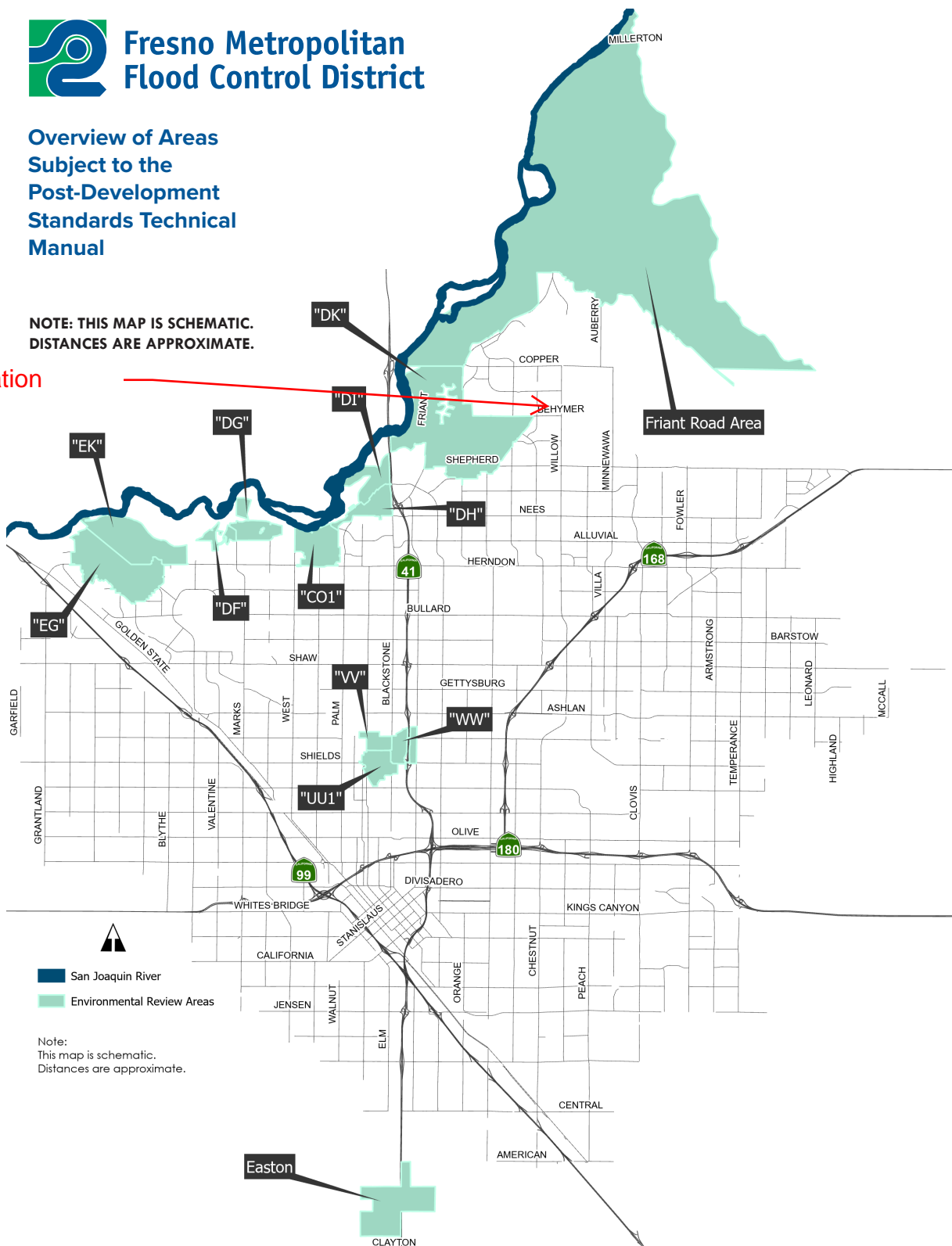


## Fresno Metropolitan Flood Control District

### Overview of Areas Subject to the Post-Development Standards Technical Manual

NOTE: THIS MAP IS SCHEMATIC. DISTANCES ARE APPROXIMATE.

Project Location



## **Appendix R:      Construction General Permit**

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Copies of the Construction Stormwater General Permit may be downloaded from the State Water Board website at:

[http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/construction.shtml](http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml).

# APPENDIX B

Project: CCC Sports Complex  
 Client: State Center Community College District  
 Location: Fresno, CA

Darden Project # 2175

## APPENDIX "B": INTERIOR COLOR SCHEDULE

<u>MATERIAL</u>	<u>MANUFACTURER</u>	<u>REF #</u>	<u>DESCRIPTION</u>
<i>POLISHED CONCRETE FINISHING</i>			
<b>Cast-in-Place Concrete</b>	-	-	Natural (no Dye or Stain)
<i>MODULAR CASEWORK</i>			
<b>Exposed Materials</b>			
Decorative Laminate			
Color 1	Wilsonart	7909-60	Fusion Maple
<i>Decorative Laminate to be Color 1, unless noted otherwise.</i>			
Color 2	Wilsonart	S6054T	Wrought Iron
Edge Banding			Match adjacent plastic laminate, UNO.
<i>Refer to Details on X/A302 for contrasting Edge Banding.</i>			
Solid Surfacing	Corian	-	Cameo White (SS-1)
<i>STOREFRONT</i>			
<b>Door</b>	Kawneer	-	Charcoal
<b>Frame</b>	Kawneer	-	Charcoal
<i>TILE</i>			
<b>Interior Cove Base Tile</b>			
CTB-1 (Base, 6" x 12")	Dal Tile	CH24	Chord, Baritone Brown
<i>Grout Color to be MAPEI 09 Grey.</i>			
<b>Interior Floor Tile</b>			
CT-1 (Large Format Tile, 12" x 24")	Dal Tile	CH24	Chord, Baritone Brown
<i>Grout Color to be MAPEI 09 Grey. Refer to Sheet A/A801 for layout.</i>			
CT-2 (Mosaic Triangle Tile)	Dal Tile	CH24	Chord, Baritone Brown
<i>Grout Color to be MAPEI 09 Grey. Refer to Sheet A/A801 for layout.</i>			
<b>Interior Wall Tile</b>			
CT-3 (6" x 18")	Dal Tile	K175	Biscuit
<i>Grout Color to be MAPEI, 14 Biscuit.</i>			
<b>Interior "Accent" Wall Tile</b>			
CT-4 (4" x 8")	Dal Tile	K175	Biscuit
CT-5 (2" x 8")	Dal Tile	K175	Biscuit
<i>Grout Color to be MAPEI, 14 Biscuit. Refer to Interior Elevations for Patterns.</i>			
<i>RESILIENT BASE AND ACCESSORIES</i>			
<b>Rubber Base</b>			
Color 1	Burke Flooring	660	Rocky

Project: CCC Sports Complex  
 Client: State Center Community College District  
 Location: Fresno, CA

Darden Project # 2175

## APPENDIX "B": INTERIOR COLOR SCHEDULE

<u>MATERIAL</u>	<u>MANUFACTURER</u>	<u>REF #</u>	<u>DESCRIPTION</u>
<b>CARPET</b>			
<b>Modular Tile: MT-1</b>			
Color 1	Mohawk	BT405, 986	Hyper Earth, Green Peridot
Color 2	Mohawk	BT405, 985	Hyper Earth, Blue Sapphire
Color 3	Mohawk	BT405, 987	Hyper Earth, Ice topaz
<i>Monolithic Installation with random even distribution of all (3) colors specified above.</i>			
<i>Refer to Sheet A/A801 for layout.</i>			
<b>PAINT</b>			
<b>Gypsum Board</b>			
Color 1	PPG to match Sherwin Williams	SW7036	Accessible Beige
<i>Unless otherwise noted.</i>			
Color 2, Accent	PPG to match Sherwin Williams	SW7642	Pavestone
Color 3, Accent	PPG to match Sherwin Williams	SW6788	Capri
Color 4, Accent—NOT USED	PPG to match Dunn Edwards	DEA139	Nautical
Color 5, Accent—NOT USED	PPG to match Dunn Edwards	DE5543	Spanish Olive
Color 6, Accent	PPG to match to Dun Edwards	DE6370	Charcoal Smudge
<i>Note: Color 6 that occurs on Gypsum Board behind Wall Protection to have Flat Finish.</i>			
Color 7, Accent	PPG		"Logo Gray" TBD
Color 8, Accent	PPG		"Logo Gray - 15% Darker" TBD
Color 9, Accent	PPG		"Black" TBD
Color 10, Accent	PPG		"White" TBD
<i>Refer to Sheet A/A801 and A/A802.</i>			
<b>Metal Doors and Frames</b>			
Color 1	PPG to match Sherwin Williams	SW7036	Accessible Beige
<i>Unless otherwise noted.</i>			
Color 6	PPG to match to Dun Edwards	DE6370	Charcoal Smudge
<i>Refer to Sheet A/A801</i>			
<b>Steel and Fabrications</b>			
Color 1	PPG to match Sherwin Williams	SW7036	Accessible Beige
<i>Unless otherwise noted.</i>			
<b>Millwork</b>			
Wood Wall Cap	PPG to match Sherwin Williams	SW6788	Capri
<b>TOILET PARTITIONS</b>			
<b>Solid Plastic Partition</b>	Scranton	Black	Black, Orange Peel
<b>PLASTIC LAMINATE LOCKERS</b>			



**Project:** CCC Sports Complex  
**Client:** State Center Community College District  
**Location:** Fresno, CA

**Darden Project #2175**

## **APPENDIX "B": INTERIOR COLOR SCHEDULE**

<u>MATERIAL</u>	<u>MANUFACTURER</u>	<u>REF #</u>	<u>DESCRIPTION</u>
<b>Team Lockers</b>			
Laminate	Wilsonart		Fusion Maple
Vinyl	RFS Sports		Tradewinds, Porpoise
Acrylic Emblem	RFS Sports		om "Crush" Logo, colors to match CCC
<b>Matching Millwork, Benches</b>			
Impact (Phenolic)	Wilsonart	7985-38	Fusion Maple

### **GENERAL NOTES:**

1. The intent of this schedule is to clarify and detail the color and patterns of finishes. All information regarding construction conditions, casework, framing and ceiling details, etc. shall be per Architectural plans, uno.
2. Interior Color Schedule to be used in conjunction with Architectural plans and Specifications.
3. Paint colors listed on Interior Color Schedule are for color reference only. Refer to Architectural Specifications and Finish Schedules for information regarding paint systems.
4. Change of paint color to occur on an inside corner, unless otherwise noted.
5. All Gypsum Board surfaces to be painted Color 1, unless otherwise noted.
6. All vision light frames in doors to match color of hollow metal door frames.
8. All access doors and frames to be painted to match color of adjacent surface, unless noted otherwise.
9. All miscellaneous exposed to view metal, plumbing and mechanical equipment receiving a field finish to be painted to match color of adjacent surface.
10. All interior ladders and ladder assemblies receiving a field finish to be painted Color 2.
11. All accent paint, changes in paint color and extent of paint and accent paint to be verified by Darden Architects at job site prior to commencement of work.
12. All finishes to extend inside accessible base cabinets.
13. All modular casework edge banding to match adjacent plastic laminate, unless noted otherwise.
14. All paints and stains are to be submitted in the form of brushouts and to Darden Architects for approval and on-site approval of accent paint locations prior to commencement of work.

# APPENDIX C

Project: CCC Sports Complex  
 Client: State Center Community College District  
 Location: Fresno, CA

Darden Project # 2175

## APPENDIX "C": EXTERIOR COLOR SCHEDULE

<u>MATERIAL</u>	<u>MANUFACTURER</u>	<u>REF #</u>	<u>DESCRIPTION</u>
<b>METAL PANELS</b>			
MP-1, Standing Seam	Centria		Color to match Campus (E) Metal Sales - Sandstone
MP-2, Box Ribbed	Centria	-	Gray Velvet
<b>STOREFRONT</b>			
Door	Kawneer	-	Charcoal
Frame	Kawneer	-	Charcoal
<b>CEMENT PLASTER</b>			
Cement Plaster			
PC-1	PPG		to match ICI 816 Swiss Coffee
<i>All Cement Plaster to be PC-1, unless otherwise noted.</i>			
PC-2	PPG		to match ICI 632 Sutton Place
PC-3	PPG		to match Dunn Edwards DE6369 Legendary Gray
PC-4	PPG		to match Sherwin Williams, SW6788, Capri
<b>TILE</b>			
Exterior Tile			
CT-6	Buchta	Neutral 10	Active White Matt
CT-7, Color 1	Buchta	Neutral 10	Active White Matt
CT-7, Color 2	Buchta	2001	Active Azure
CT-7, Color 3	Buchta	2013	Active Green
<i>Grout Color to be Selected upon Submittal. Refer to Exterior Elevations for Pattern.</i>			
<b>PAINT</b>			
Steel and Fabrications			
<b>Match to Adjacent Finish as follows, UNO.</b>			
MC-1	PPG		to match ICI 816 Swiss Coffee
<i>At Cement Plaster PC-1.</i>			
MC-2	PPG		to match ICI 632 Sutton Place
<i>At Cement Plaster PC-2</i>			
MC-3	PPG		to match Dunn Edwards DE6369 Legendary Gray
<i>At Canopy systems, Cement Plaster PC-3 and Metal Panels MP-2.</i>			
MC-4	PPG		to match Sherwin Williams, SW6788, Capri
<i>At Cement Plaster PC-4</i>			
MC-5	PPG		to match "Metal Sales - Sandstone"
<i>At Metal Panels MP-1.</i>			
MC-6	PPG		to match Dunn Edwards, DE6370, Charcoal Smudge
<i>At Metal Panels MP-2 and Metal Canopy.</i>			
Sheet Metal			match to Adjacent Finish, UNO.
Perforated Metal Signage			to match Sherwin Williams, SW6788, Capri

Project: CCC Sports Complex  
Client: State Center Community College District  
Location: Fresno, CA

Darden Project # 2175

## APPENDIX "C": EXTERIOR COLOR SCHEDULE

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### Metal Doors / Frames

Metal Doors	PPG	match to Adjacent Finish
Metal Frames	PPG	match to Adjacent Finish

### Access Doors and Frames

match to Adjacent Finish

### Metal Deck

MC-6	PPG	to match Dunn Edwards, DE6370, Charcoal Smudge
------	-----	--

*All underside of exposed metal deck adjacent to Canopy Systems.*

### Louvers

match to Adjacent Finish

### Ornamental Metal

Match (E) Campus Standard

### MISCELLANEOUS SPECIALTIES

#### Dimensional Letters

"Name of Sports Complex"	Brushed Stainless
5" Lettering	Brushed Stainless
///	to match Sherwin Williams, SW6788, Capri

### GENERAL NOTES:

1. Paint colors listed on Exterior Color Schedule are for color reference only. Refer to Architectural Specifications and Finish Schedules for type.
2. Change of color is to occur at control joints or an inside corner, unless otherwise noted.
3. Cement plaster accessories shall match primary color of adjacent material, unless otherwise noted. Cement plaster vents to remain unfinished.
4. Mechanical grille/louvers with factory baked enamel finish shall match primary color of adjacent hollow metal door frame. Louvers located in doors shall match door color.
5. All miscellaneous visual architectural sheet metal and steel fabrications including, but not limited to, mechanical/ plumbing/ electrical equipment shall match color of adjacent material, unless otherwise noted.
6. Soffits shall match color of outer face wall, unless otherwise noted.
7. Parapet caps shall match color of adjacent cement plaster.