BID ADDENDUM 3 – DSA ADDENDUM NO. 10 DATE: 10/08/2026

PROJECT:
SANGER EDUCATION COMPLEX – PHASE 3b
Development of Building L, associated site development work and Alternate Bid 1
1850 S. Fowler Ave, Fresno, CA 93727



OWNER:
SANGER UNIFIED SCHOOL DISTRICT
1905 Seventh Street
Sanger, CA 93657

ARCHITECT:
DARDEN ARCHITECTS, INC.
Attention: Mike Fennacy
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DARDEN PROJECT NO. 2171.L
DSA APPL. NO. 02-120779

It will be the responsibility of the General Contractor to submit the information contained in this addendum to all its subcontractors and suppliers. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject Bidder to disqualification.

The following additions, deletions, and revisions to the SHEETS and Project Manual are hereby made and do become a part of these Contract Documents.

INDEX OF ADDENDA TRANSMITTED HEREWITH

CHANGES TO PREVIOUS ADDENDA

ADDENDA 9 ..... AD10-CPA1

CHANGES TO SPECIFICATIONS

SPECIFICATIONS ..... AD10-SP01 THRU AD10-SP16

CHANGES TO SHEETS:

ARCHITECTURAL ..... AD10-A01 thru AD10-A03
STRUCTURAL AD10-S01
MECHANICAL ..... AD10-M01 thru AD10-M02
ELECTRICAL ..... AD10-E00 thru AD10-E45
PRODUCTION RIGGING AD10-PR01

SPECIFICATIONS:

01 5723 Storm Water Pollution Prevention Plan (SWPPP) ..... 10 pages
Attachment: SWPPP Site Maps (COI Figures) ..... 5 pages
Attachment: Stormwater Pollution Prevention Plan (BCF) ..... 530 pages
26 0519 Low Voltage Electrical Power Conductors and Cables ..... 6 pages
26 0533 Raceways and Boxes for Electrical Systems ..... 12 pages
26 0573 Overcurrent Protective Device Coordination ..... 10 pages
26 0810 Electrical Acceptance Testing ..... 4 pages
26 2413 Service and Distribution Switchboard ..... 4 pages
26 2726 Wiring Devices ..... 4 pages
26 5670 Lighting Acceptance Testing ..... 4 pages
26 7700 Assistive Listening System ..... 2 pages
26 9115 Electrical Commissioning Requirements ..... 2 pages
27 1300 Intercommunication Systems ..... 23 pages
28 5500 Emergency Responder Radio Coverage Survey ..... 4 pages
28 5510 Emergency Responder Radio Coverage System ..... 4 pages
Attachment: Fresno Fire Dept. Sec. 403.009 – ERCES ..... 14 pages

DRAWINGS:

ELECTRICAL ..... 45 SHEETS

CHANGES TO PREVIOUS ADDENDA

AD10-CPA1 Refer to Addendum 9, AD9- CBC0 1 Qualifications.

1. As a point of clarification, the Qualifications were to be submitted via the prequalification applications by no later than October 7, 2026, at 3:30 p.m., in order to be prequalified no later than five (5) business days prior to the proposal due date and remain prequalified at the time proposals are submitted.

CHANGES TO SPECIFICATIONS:

AD10-SP01 Refer to the attached SECTION 01 57 23 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

1. Add **SECTION 01 57 23 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP).**
2. Attached to Section 01 57 23 are the SWPPP Site Maps (COI Figures) and the Stormwater Pollution Prevention Plan for Sanger Education Center – Phase 3, prepared by Blair, Church & Flynn Consulting Engineers. Refer to Paragraph 1.2.B.

AD10-SP02 Refer to Section 07 81 18 – FIREPROOFING

1. Omit Specification Section 07 81 18 – FIREPROOFING and strike it out in the Table of Contents.
2. NOTE: Building L is Type II-B construction with a 0-hour fire-resistance rating for the primary structural frame. Refer to Detail A6/G006 – Fire Resistant Ratings.

AD10-SP03 Refer to Section 09 64 66 RESILIENT WOOD FLOOR

1. Refer to Paragraph 2.4.A and omit it in its entirety. Preservative or fungicide treatment of wood subfloor components, including the specified Woodlife F treatment, is not required. This revision is consistent with current guidance from the Maple Flooring Manufacturers Association (MFMA), which states that it no longer recommends Woodlife products, wood preservatives, or fire-retardant treatments for maple flooring systems or associated wood subfloor components. MFMA further notes that such treatments may introduce excess moisture into the wood and increase susceptibility to moisture-related movement and dimensional instability. [maplefloor.org][sportsfloorsinc.com]

All other moisture-control requirements of Section 09 64 66 shall remain in effect, including, but not limited to, installation of the specified vapor retarder and compliance with the concrete slab moisture testing requirements prior to installation of the athletic flooring system.

2. Revise Section 09 64 66, Paragraph 3.3, C, 5. e to read:

   "Fasten hardboard panels with screws spaced 6 inches o.c. along panel perimeter and 12 inches o.c. in the field, or as recommended by the flooring system manufacturer, whichever is more stringent."

AD10-SP04 Refer to Specification Section 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1. Omit 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES and replace the section with the attached 26 05 19 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES AD10.
2. Summary of changes: Conductor and connector requirements revised. Paragraph 2.2.A no longer permits "solid or stranded" for 12–10 AWG conductors; type THW deleted from the permitted insulation types; spring connectors / wire nuts limited to conductors 12 through 10 AWG (previously 12 through 8 AWG).

AD10-SP05 Refer to Specification Section 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

1. Omit 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS and replace the section with the attached 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS AD10.
2. Summary of changes: Underground conduit installation revised. The burial depth, joint trench, backfill and 4" sand bedding text is replaced with a reference to the trench details on the Drawings, and GRS elbows/risers shall be PVC coated.

AD10-SP06 Refer to Specification Section 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION

1. Omit 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION and replace the section with the attached 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION AD10.
2. Summary of changes: Protective equipment submittals/shop drawings may be submitted at the same time as or before the overcurrent protective device study, with the Contractor's written acknowledgment that device ratings are contingent on the final study.

AD10-SP07 Refer to Specification Section 26 08 10 – ELECTRICAL ACCEPTANCE TESTING

1. Omit 26 08 10 – ELECTRICAL ACCEPTANCE TESTING and replace the section with the attached 26 08 10 – ELECTRICAL ACCEPTANCE TESTING AD10.
2. Summary of changes: Paragraph 3.2.A, Final Settings, revised so the manufacturer's engineering service division (instead of the testing firm) is responsible for implementing final protective device settings and adjustments.

AD10-SP08 Refer to Specification Section 26 24 13 – SERVICE AND DISTRIBUTION SWITCHBOARD

1. Omit 26 24 13 – SERVICE AND DISTRIBUTION SWITCHBOARD and replace the section with the attached 26 24 13 – SERVICE AND DISTRIBUTION SWITCHBOARD AD10.
2. Summary of changes: Seismic certification reference updated from 2013 to 2019; Schneider Electric added as an acceptable switchboard manufacturer in addition to Eaton; nameplate lettering height changed from 2" to 1/2".

AD10-SP09 Refer to Specification Section 26 27 26 – WIRING DEVICES

1. Omit 26 27 26 – WIRING DEVICES and replace the section with the attached 26 27 26 – WIRING DEVICES AD10.
2. Summary of changes: Duplex receptacles shall be tamper resistant; controlled-receptacle code reference updated from 2016 to 2019; the paragraph requiring red receptacles and red cover plates on emergency circuits is deleted, and the paragraphs are renumbered.

AD10-SP10 Refer to Specification Section 26 56 70 – LIGHTING ACCEPTANCE TESTING

1. Omit 26 56 70 – LIGHTING ACCEPTANCE TESTING and replace the section with the attached 26 56 70 – LIGHTING ACCEPTANCE TESTING AD10.

AD10-SP11 Refer to Specification Section 26 77 00 – ASSISTIVE LISTENING SYSTEM

1. Omit 26 77 00 – ASSISTIVE LISTENING SYSTEM and replace the section with the attached 26 77 00 – ASSISTIVE LISTENING SYSTEM AD10.
2. Summary of changes: Owner training increased from a minimum of 2 hours to a minimum of 8 hours.

AD10-SP12 Refer to Specification Section 26 91 15 – ELECTRICAL COMMISSIONING REQUIREMENTS

1. Omit 26 91 15 – ELECTRICAL COMMISSIONING REQUIREMENTS and replace the section with the attached 26 91 15 – ELECTRICAL COMMISSIONING REQUIREMENTS AD10.
2. Summary of changes: Reference to Division 16 corrected to Division 26, and the reference to a sample lighting equipment testing appendix is deleted.

AD10-SP13 Refer to Specification Section 27 13 00 – INTERCOMMUNICATION SYSTEMS

1. Omit 27 13 00 – INTERCOMMUNICATION SYSTEMS and replace the section with the attached 27 13 00 – INTERCOMMUNICATION SYSTEMS AD10.
2. Summary of changes: Major revision. Code references updated (NEC 2002 to CEC 2019). Horizontal cabling upgraded from Category 6 to Category 6A (cable, data jacks and testing). Backbone fiber changed from 62.5/125 multimode (OFNP) to 9/125 singlemode OS2, riser rated, yellow jacket. ST/SC connector and wall-mounted rack paragraphs deleted. Named products replaced with a reference to a new Article 2.13, Parts List, which includes AV equipment (Extron) and cabling. The section increases from 22 to 23 pages.

AD10-SP14 Refer to Specification Section 28 55 00 – EMERGENCY RESPONDER RADIO COVERAGE SURVEY

1. Omit 28 55 00 – EMERGENCY RESPONDER RADIO COVERAGE SURVEY and replace the section with the attached 28 55 00 – EMERGENCY RESPONDER RADIO COVERAGE SURVEY AD10.
2. Summary of changes: Reference to the "Ohio" Building Code corrected to California; wording on testing of "critical" areas and the cross-reference to Article 1.02 deleted.

AD10-SP15 Refer to Specification Section 28 55 10 – EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

1. Omit 28 55 10 – EMERGENCY RESPONDER RADIO COVERAGE SYSTEM and replace the section with the attached 28 55 10 – EMERGENCY RESPONDER RADIO COVERAGE SYSTEM AD10.
2. Summary of changes: Owner in-service training increased from a minimum of 4 hours to a minimum of 8 hours.

AD10-SP16 **Refer to Specification Section 28 55 10 – EMERGENCY RESPONDER RADIO COVERAGE SYSTEM**

1. Refer to the attached Fresno City Fire Department ERCES Section 403.009. Add this to specification Section 28 55 10.
2. The Fresno City Fire Department ERCES Section 403.009 document governs in the case of conflicts.

CHANGES TO SHEETS:

ARCHITECTURAL:

AD10-A01 **Refer to Detail A8/X/A101 – Head of Wall Conditions at Beams & Deck Edge:**

1. Revise the note "FIREPROOFING, Where Occurs" to read: "FIREPROOFING, Where Occurs. **See Detail A6/G006 for Fire-Resistance Rating locations**."
2. Per Detail A6/G006 – Fire Resistant Ratings, Building L is Type II-B construction with a 0-hour fire-resistance rating for the primary structural frame. Fireproofing is not required for Building L.

AD10-A02 **Refer to Sheet L/A141.4**

1. WOOD ATHLETIC FLOORING – SLEEPER SPACING
2. Refer to details N11-L/A141.4 and E11-L/A141.4 and revise the spacing of the sleepers to be 16" o.c. as required by Section 09 64 66, Paragraph 3.3.C.2.

AD10-A03 **Refer to Sheet L/A604.4 – Interior Elevations.**

1. Some bidders have asked questions about the door marks in the interior elevations.
2. Refer to the Floor Plans for the Door Marks, and the Opening Schedules for the Door Type information. Door Marks are not indicated in the Interior Elevations.

STRUCTURAL:

AD10-S01 Refer to Structural Sheet S521.4, Detail 5:

1. Omit the note "C5 and HSS per arch and tension grid MFR" and replace with: "C5 CHANNEL FRAMES, HORIZONTAL HSS PERIMETER MEMBERS, HANGER BOTTOM PLATES, AND CONNECTIONS BY TENSION GRID DELEGATED DESIGNER. DEFERRED APPROVAL ITEM #7. REFER TO SPECIFICATION SECTION 11 61 33."
2. Add the following notes to the structural sheet

NOTE

1. Refer to the Tension Grid System at Room L115. This is a Deferred Approval Item.
2. Member sizes and connection details for the tension grid framing are intentionally not shown on the Contract Documents.
3. They shall be provided by the Contractor's delegated designer and submitted to DSA for approval as a deferred submittal.
4. The Contractor shall include in the Base Bid the complete design, engineering, DSA submittal, fabrication, and installation of the tension grid system, as described below.

A. Work designed by the Structural Engineer of Record (shown on Structural Drawings):

1. Roof steel supporting the tension grid.
2. Vertical HSS hangers.
3. Vertical and diagonal bracing at the hangers, as shown.

B. Work by the Contractor's delegated designer (Deferred Approval):

The Contractor shall provide all tension grid work not listed in Paragraph A, including but not limited to:

1. C5 channel tension grid frames.
2. Horizontal HSS perimeter frame members.
3. Hanger bottom plates and their connections to the vertical HSS hangers.
4. Welded tabs at quarter points and around hangers.
5. Woven wire rope tension grid panels.
6. All connections between the delegated components and the work in Paragraph A, including all field welding.
7. Any additional bracing, stiffeners, or supplemental framing required by the delegated design to resist gravity or seismic loads.

Where the Contract Documents assign any item in Paragraph B to "structural work," that item shall nevertheless be included in the delegated design and in the Contractor's bid.

C. Work under Architectural:

1. Perimeter guardrails (1-1/2" Schedule 40 pipe railing) per the Architectural Drawings.

D. Design criteria:

1. Tension grid design load: 25 psf total (5 psf grid panel dead load plus 20 psf live load for technicians and added equipment).
2. Seismic design of all delegated components per the 2022 California Building Code and ASCE 7-16, using the project seismic design criteria on the Structural Drawings.
3. Refer to Specification Section 11 61 33, Article 2.4 Tension Grid, for additional requirements.

E. Submittal requirements:

1. The delegated designer shall be an engineer licensed in the State of California. Drawings, specifications, and calculations shall be signed and sealed by a structural engineer, licensed in the state of California.
2. Calculations shall show the reactions imposed on the hangers and bracing in Paragraph A. If the delegated design requires changes to any work in Paragraph A, the Contractor shall identify those changes in the submittal. Changes require review by the Structural Engineer of Record.
3. The submittal shall be reviewed by the Architect and Structural Engineer of Record and approved by DSA before fabrication or installation begins, per the Deferred Approval notes and Section 01 33 00.

MECHANICAL:

AD10-M01 Refer to Mechanical Drawing L/M401.4

1. Provide an outside air intake hood and a relief air discharge hood at the locations indicated on Drawing L/M401.4 at grid lines L11 and LD.
2. The basis of design shall be Greenheck Models FGI and FGR, complete with curb cap and birdscreen.
3. Throat sizes shall be as indicated on Sheet L/M401.4. Refer to Detail A-X/M102 in this Addendum. Include all required accessories and appurtenances necessary for a complete and operational installation. Manufacturer and model information for the intake and relief hoods is provided herein as the basis of design.
4. Provide ROOF ACCESSORIES, Manufactured Equipment Curbs. See Detail E7-X/A508.

AD10-M02 Refer to Mechanical Drawings L/M201.4 and L/M202.4

1. Refer to Mechanical Drawing L/M201.4, Keynote #1, and Mechanical Drawing L/M202.4, Keynote #11.
2. These Keynotes govern.
3. Provide 1" acoustic duct lining on all rectangular supply ductwork downstream of VAV boxes, from the VAV box discharge to the last branch takeoff / diffuser connection, whether or not lining is graphically indicated on the plans.
4. Round branch runouts to grilles and diffusers shall be internally lined. If not lined provide exterior duct wrap insulation per Section 23 07 13.

ELECTRICAL:

AD10-E00 General

1. Omit the following forty-five (45) Electrical sheets and replace them with the attached sheets marked Addendum No. 10.
2. The changes are clouded.
3. Sheet L/E203.4 issued with this Addendum supersedes Sheet L/E203.4 issued under Addendum No. 9, Item AD9-E01.
4. Sheets SD/E101, SD/E106, SD/E201, SD/E206, SD/T101, and SD/T106 issued with this Addendum are Contract Documents. Record (as-built) drawings with the same sheet numbers listed in Document 00 31 19 – EXISTING CONDITION INFORMATION are for information only and are not part of the Contract Documents.

AD10-E01 Refer to Sheet SD/E101 – PARTIAL SITE LIGHTING PLAN

1. Omit Sheet SD/E101 and replace it with the attached Sheet SD/E101 AD10.
2. The changes are clouded.
3. Summary of changes: Existing site lighting branch circuits HM1-2,4 are intercepted, extended and connected to the new site lighting fixtures.

AD10-E02 Refer to Sheet SD/E106 – PARTIAL SITE LIGHTING PLAN

1. Omit Sheet SD/E106 and replace it with the attached Sheet SD/E106 AD10.
2. The changes are clouded.
3. Summary of changes: Existing branch circuit EM1-11,13 is intercepted at the existing lighting fixture and connected to the new site lighting fixtures; HM1-2,4 circuiting revised.

AD10-E03 Refer to Sheet SD/E201 – PARTIAL SITE ELECTRICAL PLAN

1. Omit Sheet SD/E201 and replace it with the attached Sheet SD/E201 AD10.
2. The changes are clouded.

3. Summary of changes: Existing site feeders/conduits are intercepted, extended and connected to panels DPL and EL1.

AD10-E04 Refer to Sheet SD/E206 – PARTIAL SITE ELECTRICAL PLAN

1. Omit Sheet SD/E206 and replace it with the attached Sheet SD/E206 AD10.
2. The changes are clouded.
3. Summary of changes: Existing site feeders/conduits are intercepted, extended and connected to panels DPL and EL1.

AD10-E05 Refer to Sheet SD/T101 – PARTIAL SITE COMMUNICATIONS PLAN

1. Omit Sheet SD/T101 and replace it with the attached Sheet SD/T101 AD10.
2. The changes are clouded.
3. Summary of changes: Existing pathway is intercepted, extended and connected to fire alarm control panel FACP-L.

AD10-E06 Refer to Sheet SD/T106 – PARTIAL SITE COMMUNICATIONS PLAN

1. Omit Sheet SD/T106 and replace it with the attached Sheet SD/T106 AD10.
2. The changes are clouded.

AD10-E07 Refer to Sheet X/E001 – GENERAL NOTES, SYMBOLS LEGEND, AND ABBREVIATIONS

1. Omit Sheet X/E001 and replace it with the attached Sheet X/E001 AD10.
2. The changes are clouded.
3. Summary of changes: Abbreviations and symbols added (ERRCS, EVCS, EPO, DACT, DMX, RGBW, production lighting device, TMGB/TGB, TVSS, MDF/IDF, indoor/outdoor unit), and a general note added for power, data and HDMI pass-through at display monitors.

AD10-E08 Refer to Sheet X/E101 – SINGLE LINE DIAGRAM

1. Omit Sheet X/E101 and replace it with the attached Sheet X/E101 AD10.
2. The changes are clouded.
3. Summary of changes: Existing medium-voltage Switch #2 revised: replace existing 200A fuses with Eaton 15.5kV RBA-800 fuse holders with 300E refills, and replace the existing current transformer and ammeter to suit the new fuses; existing equipment designations clarified.

AD10-E09 Refer to Sheet X/E102 – SINGLE LINE DIAGRAM

1. Omit Sheet X/E102 and replace it with the attached Sheet X/E102 AD10.
2. The changes are clouded.
3. Summary of changes: Single line diagram revised for the 133 kVA (160A) feeders, panels LLM2 and ARP-2, and breaker trip functions (L,S,I / L,S,I,G).

AD10-E10 Refer to Sheet X/E104 – SINGLE LINE DIAGRAM SCHEDULES

1. Omit Sheet X/E104 and replace it with the attached Sheet X/E104 AD10.
2. The changes are clouded.
3. Summary of changes: Feeder schedule conductor sizes revised; grounding and bonding diagram updated to 2019 CEC references, including the ground to the telecom room ground bars; arc flash warning label requirements (ANSI Z535 / NFPA 70E) added.

AD10-E11 Refer to Sheet X/E105 – LIGHTING FIXTURE SCHEDULE

1. Omit Sheet X/E105 and replace it with the attached Sheet X/E105 AD10.
2. The changes are clouded.
3. Summary of changes: Lighting fixture schedule revised, including new or revised step lights (Hydrel HSL13 and recessed dimmable step lights), LED jelly-jar fixtures above the catwalk, LED pendants and high-bay fixtures, and triple-head site lighting fixtures; color temperature note added.

AD10-E12 Refer to Sheet X/E106 – ELECTRICAL SCHEDULES

1. Omit Sheet X/E106 and replace it with the attached Sheet X/E106 AD10.
2. The changes are clouded.
3. Summary of changes: Panel schedules revised.

AD10-E13 Refer to Sheet X/E107 – ELECTRICAL SCHEDULES

1. Omit Sheet X/E107 and replace it with the attached Sheet X/E107 AD10.
2. The changes are clouded.
3. Summary of changes: Panel schedule revisions for panels LLM2, AV-1 and ARP-2.

AD10-E14 Refer to Sheet X/E201 – ELECTRICAL DETAILS

1. Omit Sheet X/E201 and replace it with the attached Sheet X/E201 AD10.
2. The changes are clouded.
3. Detail 2 scale updated to be “NTS”.

AD10-E15 Refer to Sheet X/E204 – ELECTRICAL DETAILS

1. Omit Sheet X/E204 and replace it with the attached Sheet X/E204 AD10.
2. The changes are clouded.
3. Summary of changes: Elevator circuit schedule revised (elevator equipment room exhaust fan 696 VA; elevator construction receptacle 4000 VA).

AD10-E16 Refer to Sheet X/E205 – ELECTRICAL DETAILS

1. Omit Sheet X/E205 and replace it with the attached Sheet X/E205 AD10.
2. The changes are clouded.

AD10-E17 Refer to Sheet X/E208 – ELECTRICAL DETAILS

1. Omit Sheet X/E208 and replace it with the attached Sheet X/E208 AD10.
2. The changes are clouded.
3. Summary of changes: Pendant fixture mounting detail added (Unistrut channel, swivel canopy, stem lengths, and aircraft cable restraint where the fixture swing is obstructed).

AD10-E18 Refer to Sheet X/E300 – LIGHTING CONTROL SYSTEM GENERAL NOTES

1. Omit Sheet X/E300 and replace it with the attached Sheet X/E300 AD10.
2. The changes are clouded.

AD10-E19 Refer to Sheet X/E301 – LIGHTING CONTROL PANELS

1. Omit Sheet X/E301 and replace it with the attached Sheet X/E301 AD10.
2. The changes are clouded.

AD10-E20 Refer to Sheet X/E302 – LIGHTING CONTROL DETAILS

1. Omit Sheet X/E302 and replace it with the attached Sheet X/E302 AD10.
2. The changes are clouded.
3. Summary of changes: Minor note revision (Category 6 cable reference).

AD10-E21 Refer to Sheet X/E303 – TYPICAL LIGHTING CONTROL WIRING DIAGRAMS AND INSTALLATIONS

1. Omit Sheet X/E303 and replace it with the attached Sheet X/E303 AD10.
2. The changes are clouded.
3. Summary of changes: Notes added referencing maximum cable lengths on Sheet X/E300 and 2019 CEC 410.69.

AD10-E22 Refer to Sheet X/E500 – FIRE ALARM RISER DIAGRAM – BUILDING L

1. Omit Sheet X/E500 and replace it with the attached Sheet X/E500 AD10.
2. The changes are clouded.
3. Summary of changes: Fire alarm riser revised for Building L notification devices (15cd strobes and speaker taps, including restroom devices), the fire alarm fiber optic network (multimode fiber, LIU-to-FACP jumpers, Gamewell-FCI cabinet and FML-E3 modules), and the circuit disconnect labeling note.

AD10-E23 Refer to Sheet X/E503 – FIRE ALARM DETAILS

1. Omit Sheet X/E503 and replace it with the attached Sheet X/E503 AD10.
2. The changes are clouded.
3. Summary of changes: Fire alarm details revised/added, including the HVAC unit shutdown contactor detail, typical Light Interface Unit (LIU) installation detail 14, equipment accessibility notes and 2019 code references.

AD10-E24 Refer to Sheet X/E504 – FIRE ALARM CALCULATIONS – BUILDING L

1. Omit Sheet X/E504 and replace it with the attached Sheet X/E504 AD10.
2. The changes are clouded.

AD10-E25 Refer to Sheet X/T201 – COMMUNICATIONS GENERAL NOTES AND SCHEDULE

1. Omit Sheet X/T201 and replace it with the attached Sheet X/T201 AD10.
2. The changes are clouded.
3. Summary of changes: Communications device schedule revised, including a recording light with 2-gang double-depth box and Belden 9740 home run to the AV rack.

AD10-E26 Refer to Sheet X/T202 – SITE COMMUNICATIONS RISER DIAGRAM

1. Omit Sheet X/T202 and replace it with the attached Sheet X/T202 AD10.
2. The changes are clouded.
3. Summary of changes: Riser note revised to reference IDF Room 108.

AD10-E27 Refer to Sheet X/T203 – BUILDING L COMMUNICATIONS RISER DIAGRAM

1. Omit Sheet X/T203 and replace it with the attached Sheet X/T203 AD10.
2. The changes are clouded.
3. Summary of changes: Rack details revised: vertical cable management, Category 6/6A patch panels, rack-mounted fiber optic splice enclosures and the rack maximum weight note.

AD10-E28 Refer to Sheet L/E101.4 – BUILDING L FIRST FLOOR LIGHTING PLAN AREA A

1. Omit Sheet L/E101.4 and replace it with the attached Sheet L/E101.4 AD10.
2. The changes are clouded.
3. Summary of changes: First floor lighting circuiting revised (EL1-5 emergency circuits, LL3-58, ARP-2), branch circuit routing through the emergency transfer switch, and dressing room ‘DR’ fixtures routed through the lighting controls contactor.

AD10-E29 Refer to Sheet L/E102.4 – BUILDING L FIRST FLOOR LIGHTING PLAN AREA B

1. Omit Sheet L/E102.4 and replace it with the attached Sheet L/E102.4 AD10.

2. The changes are clouded.
3. Summary of changes: Minor circuiting revision (LL3-58) and reference note to Sheet L/E102LC.4.

AD10-E30 Refer to Sheet L/E101LC.4 – BUILDING L FIRST FLOOR LIGHTING CONTROLS PLAN AREA A

1. Omit Sheet L/E101LC.4 and replace it with the attached Sheet L/E101LC.4 AD10.
2. The changes are clouded.
3. Summary of changes: Lighting control device designations revised.

AD10-E31 Refer to Sheet L/E102LC.4 – BUILDING L FIRST FLOOR LIGHTING CONTROLS PLAN AREA B

1. Omit Sheet L/E102LC.4 and replace it with the attached Sheet L/E102LC.4 AD10.
2. The changes are clouded.
3. Summary of changes: Minor lighting control device designation revision.

AD10-E32 Refer to Sheet L/E103.4 – BUILDING L SECOND FLOOR LIGHTING PLAN AREA A

1. Omit Sheet L/E103.4 and replace it with the attached Sheet L/E103.4 AD10.
2. The changes are clouded.
3. Summary of changes: Second floor lighting circuiting revised (EL1-5, HL1-13 for type B1 fixtures, ARP-2, TRP-1, BCELTS-1).

AD10-E33 Refer to Sheet L/E103LC.4 – BUILDING L SECOND FLOOR LIGHTING CONTROLS PLAN AREA A

1. Omit Sheet L/E103LC.4 and replace it with the attached Sheet L/E103LC.4 AD10.
2. The changes are clouded.
3. Summary of changes: Lighting control device designations revised.

AD10-E34 Refer to Sheet L/E201.4 – BUILDING L FIRST FLOOR ELECTRICAL PLAN AREA A

1. Omit Sheet L/E201.4 and replace it with the attached Sheet L/E201.4 AD10.
2. The changes are clouded.
3. Summary of changes: Power plan circuiting revised (panels LLM2, AV-1 and AV-1B for AV equipment, PLD, LL1, LL2), and a cord reel mounting detail added.

AD10-E35 Refer to Sheet L/E202.4 – BUILDING L FIRST FLOOR ELECTRICAL PLAN AREA B

1. Omit Sheet L/E202.4 and replace it with the attached Sheet L/E202.4 AD10.
2. The changes are clouded.
3. Summary of changes: Circuiting revised (LLM2, LL4, AV-1B, PLB-FP); Unistrut supports for cord reels (typical of 4) and an electric hand dryer connection note added.

AD10-E36 Refer to Sheet L/E203.4 – BUILDING L SECOND FLOOR ELECTRICAL PLAN AREA A

1. Omit Sheet L/E203.4, including the sheet issued under Addendum No. 9, and replace it with the attached Sheet L/E203.4 AD10.
2. The changes are clouded.
3. Summary of changes: Second floor power circuiting revised (PLB/PLD, AV-1A, TRP-1, TLM, LL3), and note 15 added: power company switch furnished and installed by the Electrical Contractor (refer to Section 26 05 35).

AD10-E37 Refer to Sheet L/E301.4 – BUILDING L ROOF ELECTRICAL PLAN AREA A

1. Omit Sheet L/E301.4 and replace it with the attached Sheet L/E301.4 AD10.
2. The changes are clouded.
3. Summary of changes: Roof electrical circuiting revised (HLM1, LLM1), and note 8 added for the pump VFDs with flexible connections (coordinate with the Mechanical drawings).

AD10-E38 Refer to Sheet L/E302.4 – BUILDING L ROOF ELECTRICAL PLAN AREA B

1. Omit Sheet L/E302.4 and replace it with the attached Sheet L/E302.4 AD10.
2. The changes are clouded.
3. Summary of changes: Roof electrical circuiting revised (HLM1, LLM1).

AD10-E39 Refer to Sheet L/FA201.4 – BUILDING L FIRST FLOOR FIRE ALARM PLAN AREA A

1. Omit Sheet L/FA201.4 and replace it with the attached Sheet L/FA201.4 AD10.
2. The changes are clouded.
3. Summary of changes: Fire alarm devices added in enlarged toilet plans L103 and L105 (15cd strobes on circuit N2, device addresses); door/damper release note and a schematic conduit general note added.

AD10-E40 Refer to Sheet L/FA202.4 – BUILDING L FIRST FLOOR FIRE ALARM PLAN AREA B

1. Omit Sheet L/FA202.4 and replace it with the attached Sheet L/FA202.4 AD10.
2. The changes are clouded.
3. Summary of changes: Fire alarm devices added in enlarged toilet plan L132/L133 (15cd strobes on circuit N5, device addresses); door/damper release note and a schematic conduit general note added.

AD10-E41 Refer to Sheet L/FA203.4 – BUILDING L SECOND FLOOR FIRE ALARM PLAN AREA A

1. Omit Sheet L/FA203.4 and replace it with the attached Sheet L/FA203.4 AD10.
2. The changes are clouded.
3. Summary of changes: Damper release note (see detail 11-X/E503) and a schematic conduit general note added.

AD10-E42 Refer to Sheet L/FA204.4 – BUILDING L SECOND FLOOR FIRE ALARM PLAN AREA B

1. Add the attached Sheet L/FA204.4 – BUILDING L SECOND FLOOR FIRE ALARM PLAN AREA B AD10 to the Drawings.
2. The changes are clouded.
3. Summary of changes: New sheet. Sheet L/FA204.4 was not included in the bid set drawings.

AD10-E43 Refer to Sheet L/T201.4 – BUILDING L FIRST FLOOR COMMUNICATIONS PLAN AREA A

1. Omit Sheet L/T201.4 and replace it with the attached Sheet L/T201.4 AD10.
2. The changes are clouded.
3. Summary of changes: Enlarged plan at IDF 108 revised (cable runway, rack clearances and anchorage), recording light and telecommunications ground bus bar notes added, and a note that all category cabling is served by IDF 108.

AD10-E44 Refer to Sheet L/T202.4 – BUILDING L FIRST FLOOR COMMUNICATIONS PLAN AREA B

1. Omit Sheet L/T202.4 and replace it with the attached Sheet L/T202.4 AD10.
2. The changes are clouded.
3. Summary of changes: Note added: all category cabling shown shall be served by IDF 108, unless noted.

AD10-E45 Refer to Sheet L/T203.4 – BUILDING L SECOND FLOOR COMMUNICATIONS PLAN AREA A

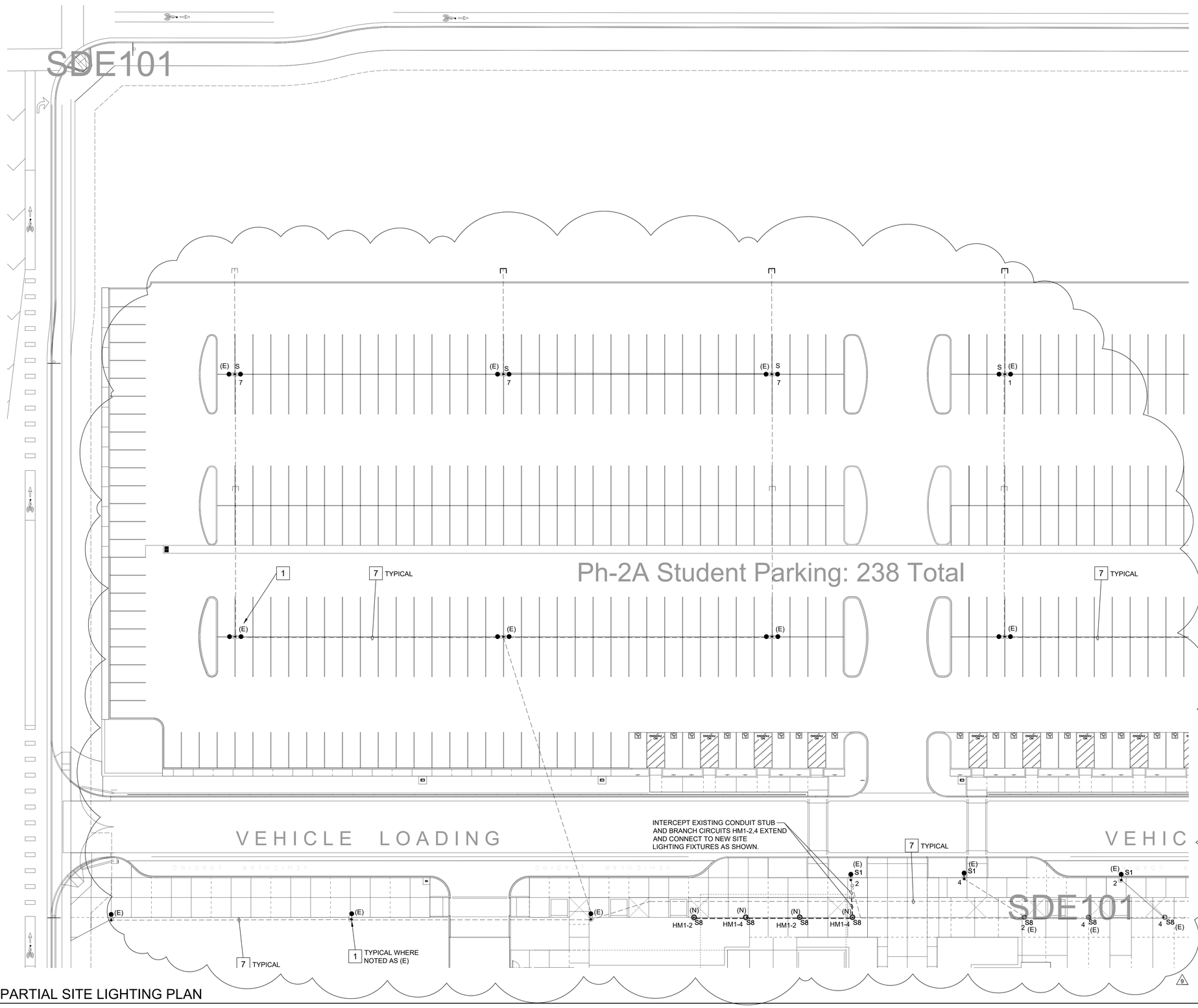
1. Omit Sheet L/T203.4 and replace it with the attached Sheet L/T203.4 AD10.
2. The changes are clouded.
3. Summary of changes: IDF 108 references and conduits revised; note added that all category cabling shall be served by IDF 108, unless noted.

PRODUCTION RIGGING:

AD10-PR01 Refer to Sheet L/PR501.4, Detail 2:

1. Omit the notes "TENSION GRID PERIMETER FRAME (UNDER STRUCTURAL WORK) (SSD)" and "(PLATE BY STRUCTURAL)" and replace with: "TENSION GRID PERIMETER FRAME AND BOTTOM PLATE BY TENSION GRID DELEGATED DESIGNER, DEFERRED APPROVAL ITEM #7."
2. Refer to Structural Sheet S521.4 for additional notes for the Tension Grid.

END OF ADDENDUM NO. 10



PARTIAL SITE LIGHTING PLAN

SCALE: 1"=20'-0"

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DSA File No.:
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☐ Sheet Reference Notes

1. EXISTING SITE LIGHTING FIXTURE TO REMAIN, PROTECT IN PLACE.
2. ROUTE BRANCH CIRCUIT(S) THROUGH LIGHTING CONTROL PANEL, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
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5. 11" X 17" PULLBOX AT FUTURE SPORTS LIGHTING FIXTURE LOCATION.
6. FUTURE SPORTS LIGHTING CABINET LOCATION.
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SEE SHEET X/E105 FOR LIGHTING FIXTURE SCHEDULE.

REFER TO SHEET X/E201 FOR CONDUIT IN TRENCH DETAIL AND TYPICAL SITE DETAILS.

REFER TO SHEET X/E202 FOR POLE MOUNTED FIXTURE CONCRETE BASE DETAILS.

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REGISTERED PROFESSIONAL ENGINEER WILLIAM A. THOMA ELECTRICAL STATE OF CALIFORNIA

EXPIRES: 06/30/25

Consultant THOMA #22-8060

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LICENSED ARCHITECT MICHAEL K. FENNOY No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

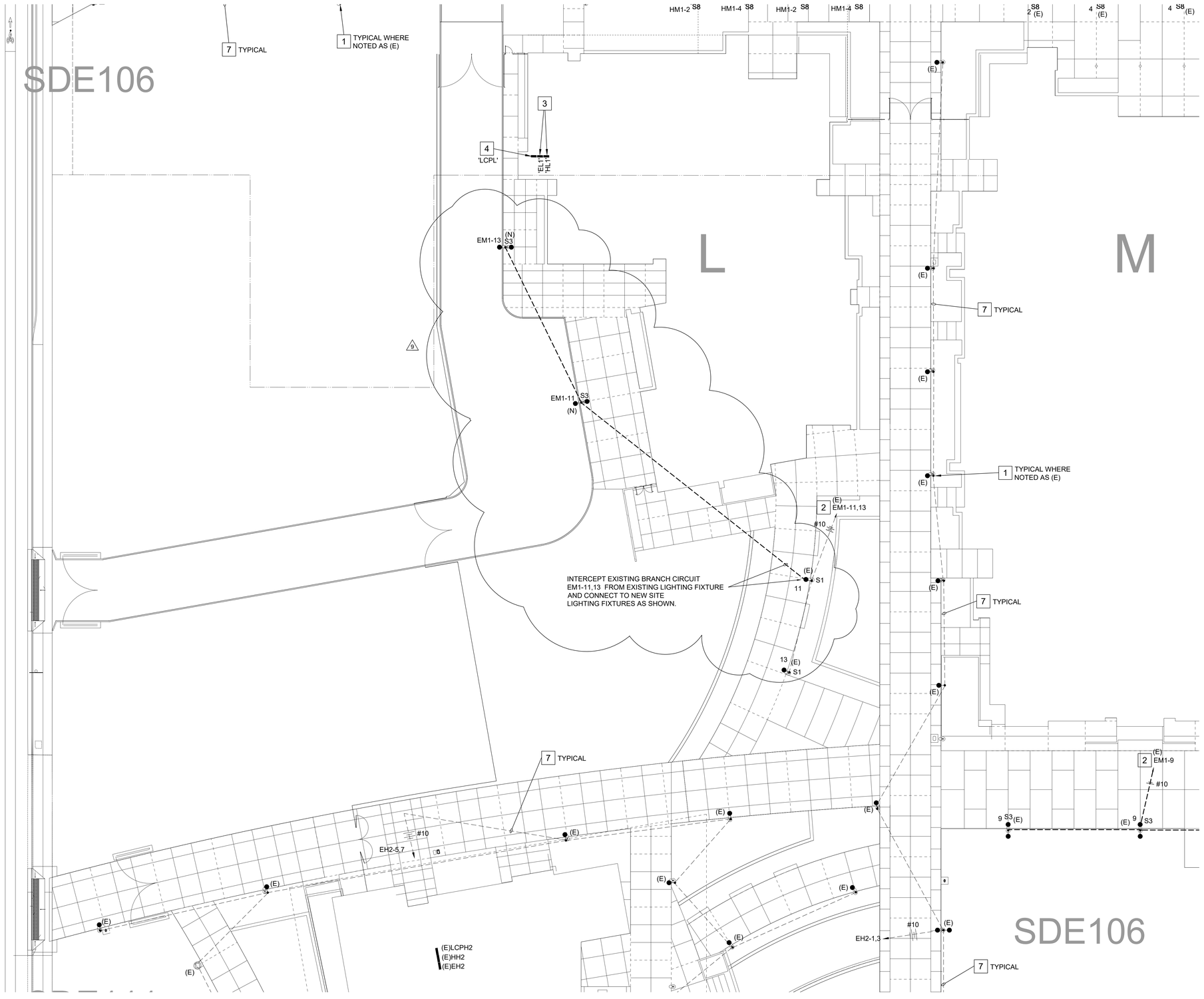
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Drawn By:
Checked By:
Reviewed By:

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Project Number: 2171
Date: 08/27/24

SD/E101
AD10

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PARTIAL SITE LIGHTING PLAN

SCALE: 1"=20'-0"

DSA File No.:
DSA File

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LICENSED ARCHITECT RUSSELL K. FENWICK No. C23724 Date 4-30-27 STATE OF CALIFORNIA
Architect

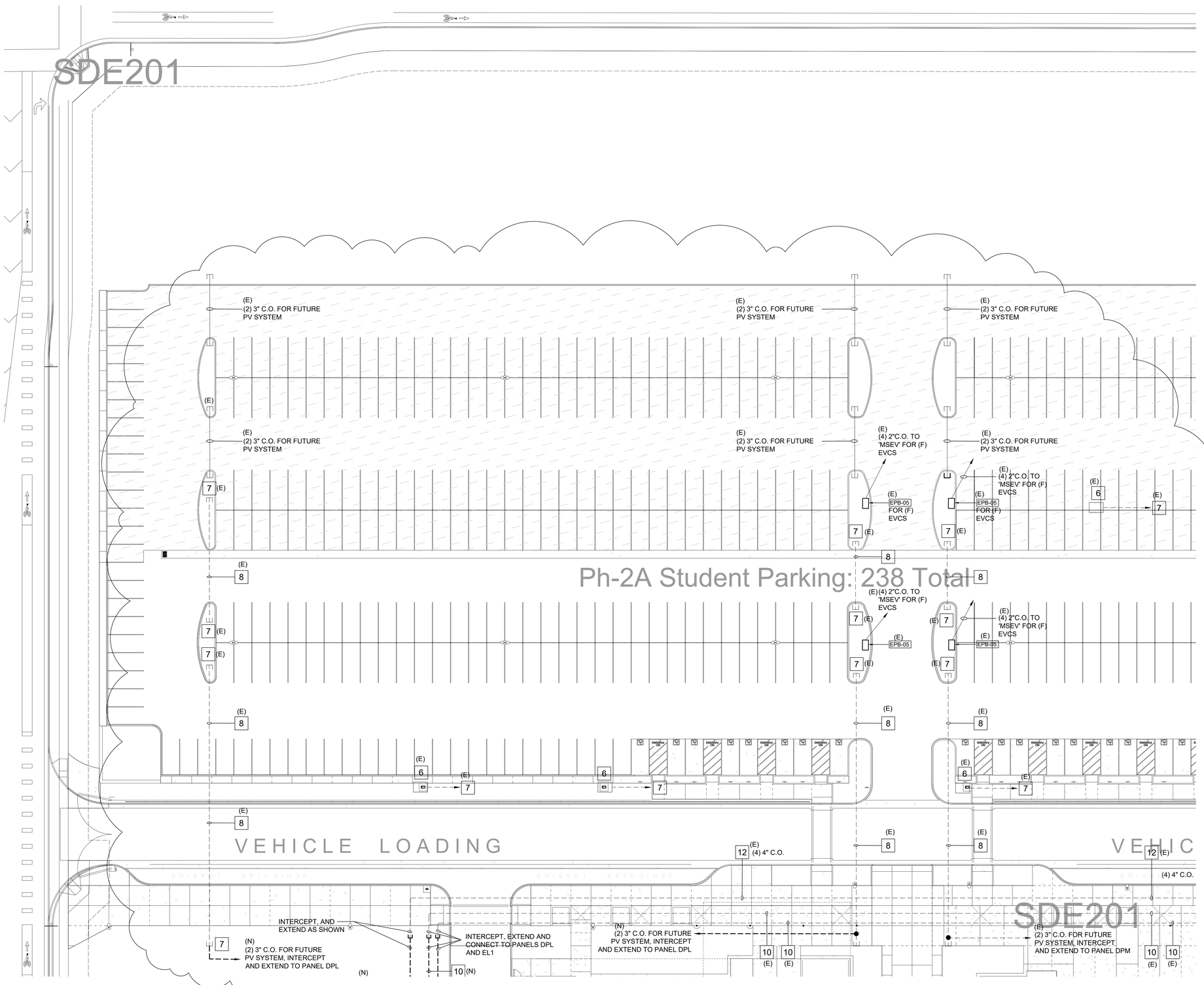
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28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

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PARTIAL SITE ELECTRICAL PLAN

SCALE: 1"=20'-0"

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DSA File

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11. CAST OUTLET BOX WITH GFI RECEPTACLE AND WHILE IN USE CAST TYPE COVER, SEE DETAIL 6-X/E206 FOR MOUNTING.
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LICENSED ARCHITECT
ANDREW K. FENNOY
No. C23724
Exp. 4-30-27
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Architect

No.	Revision/Submission	Date
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28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

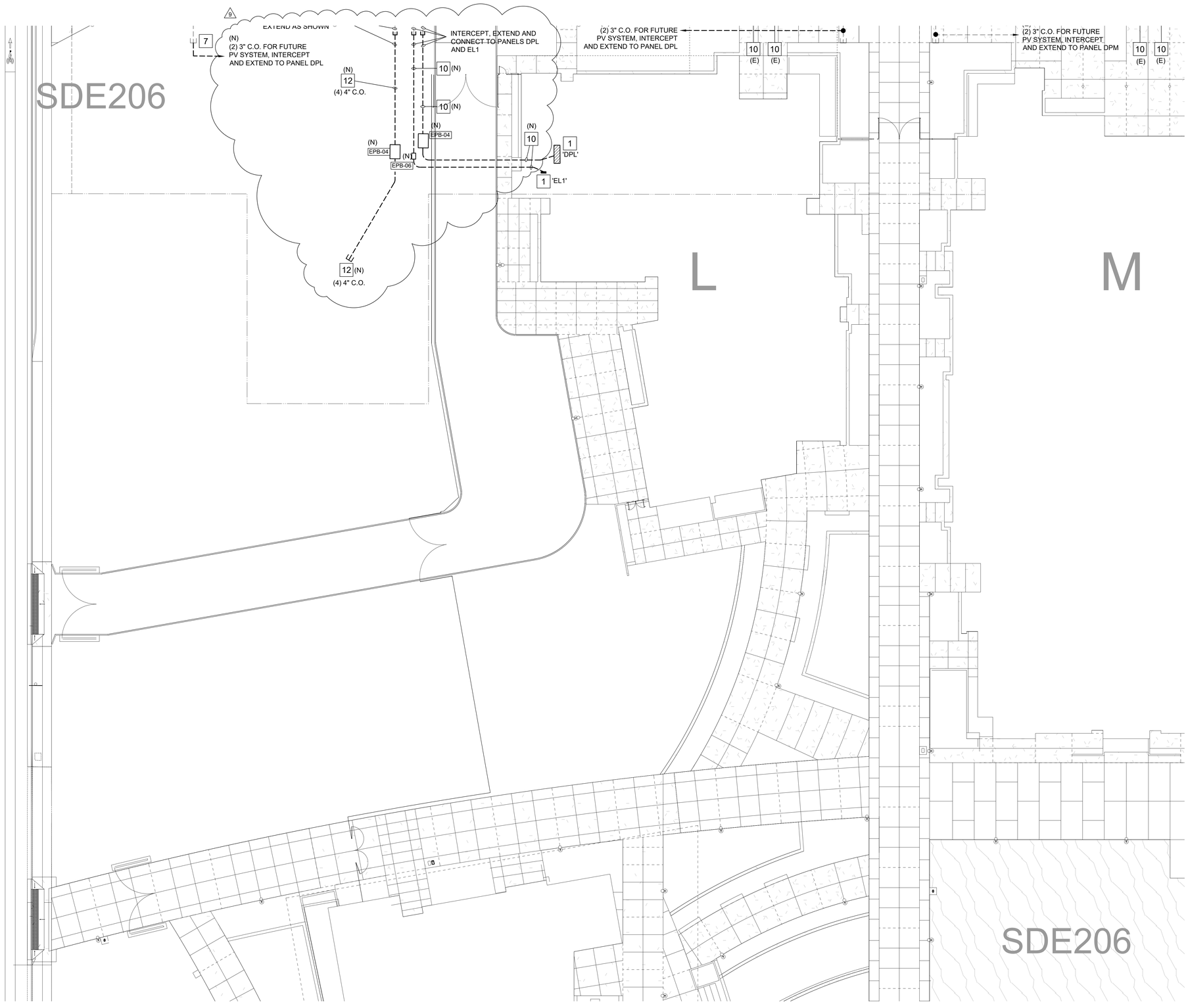
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Reviewed By:

Scale: As indicated
Project Number: 2171
Date: 08/27/24

SD/E201
AD10

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PARTIAL SITE ELECTRICAL PLAN

SCALE: 1"=20'-0"

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DSA File No.:
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LICENSED ARCHITECT
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REG. 4-30-27
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Architect

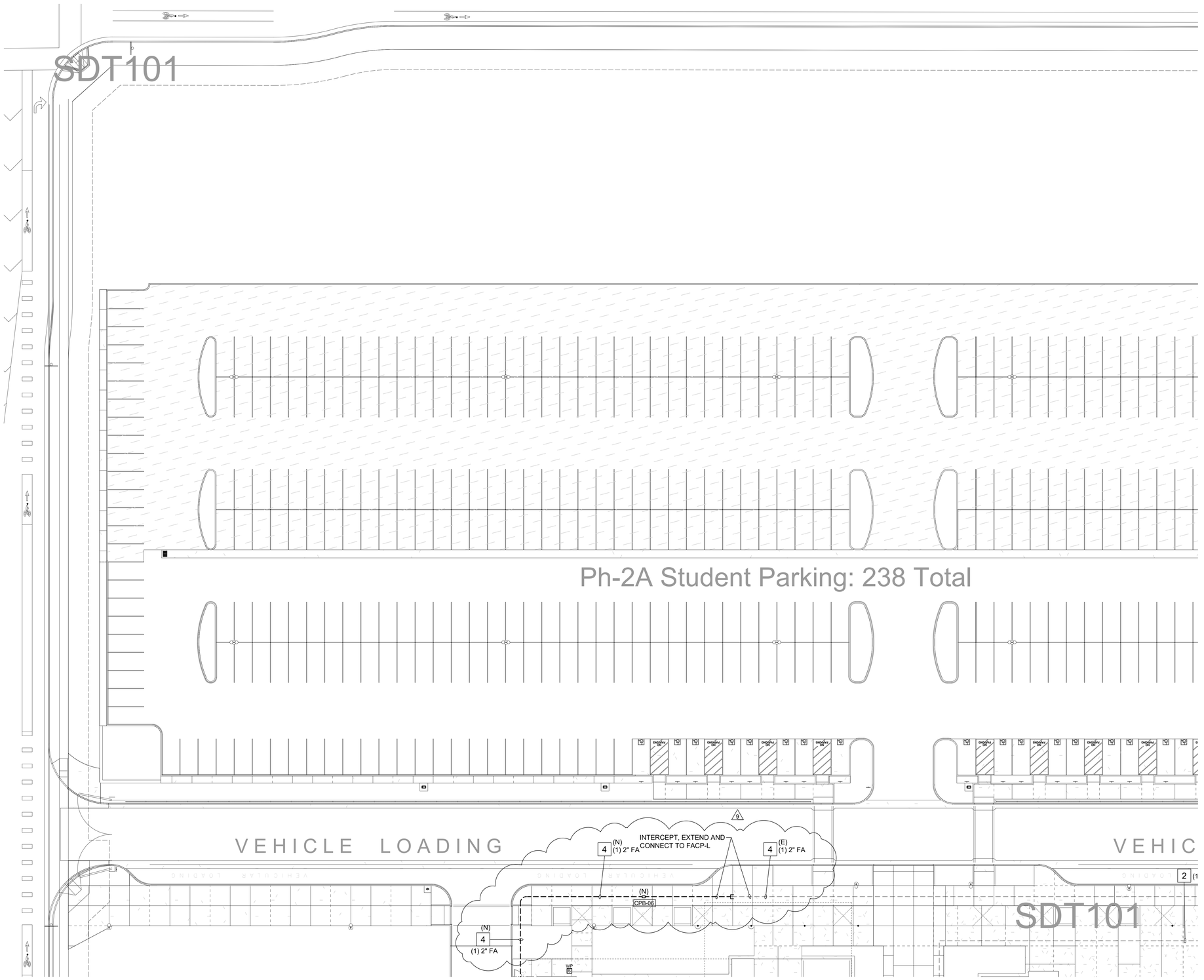
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Revision

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SD/E206
AD10

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PARTIAL SITE COMMUNICATIONS PLAN

SCALE: 1"=20'-0"

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

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2. EXISTING COMMUNICATION SYSTEMS CONDUITS TO REMAIN, SIZE AND QUANTITY INDICATED, CONTRACTOR TO CONFIRM EXACT LOCATION AND PROTECT IN PLACE.
3. NEW COMMUNICATION SYSTEMS CONDUITS, SIZE AND QUANTITY INDICATED.
4. NEW FIRE ALARM SYSTEM CONDUIT(S), SIZE AND QUANTITY INDICATED.
5. 11" X 17" PULLBOX.
6. APPROXIMATE LOCATION OF NEW / EXISTING DATA MDF / IDF ROOM, REFER TO COMMUNICATION FLOOR PLANS AND COMMUNICATION RISER DIAGRAM FOR ADDITIONAL INFORMATION.
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THE EXACT QUANTITY, LOCATION AND DEPTHS OF EXISTING UNDERGROUND PIPING AND CONDUITS IS UNKNOWN. VERIFY AND MAINTAIN EXISTING UTILITIES IN SERVICE AND PROTECT THEM AGAINST DAMAGE DURING DEMOLITION AND EXCAVATION OPERATIONS.

REPAIR AND RECONNECT ALL EXISTING UNDERGROUND PIPING UNCOVERED AND DAMAGED BY NEW WORK AS REQUIRED TO MAINTAIN PROPER SYSTEM FUNCTIONS. RE-TEST ALL SYSTEMS DAMAGED BY NEW WORK.

LOCATIONS OF EXISTING UNDERGROUND (UG) UTILITY SYSTEMS SHALL BE DETERMINED BY CALLING UNDERGROUND SERVICE ALERT (USA). WHEN PLANNING UNDERGROUND WORK, AND BEFORE YOU DIG, CONTACT UNDERGROUND SERVICE ALERT (USA) AT LEAST 48 HOURS PRIOR TO EXCAVATION (WEEKENDS EXCLUDED) FOR THE LOCATION OF UNDERGROUND GAS AND ELECTRIC LINES OR EQUIPMENT.

SAWCUT AND PATCH ALL SURFACES TO MATCH EXISTING SURFACES (CONCRETE, AC PAVING, ETC.) COMPLETE FIELD VERIFICATION OF THIS WORK IS REQUIRED.

General Notes

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Project

SITE DEVELOPMENT

PARTIAL SITE COMMUNICATIONS PLAN
Drawing

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No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

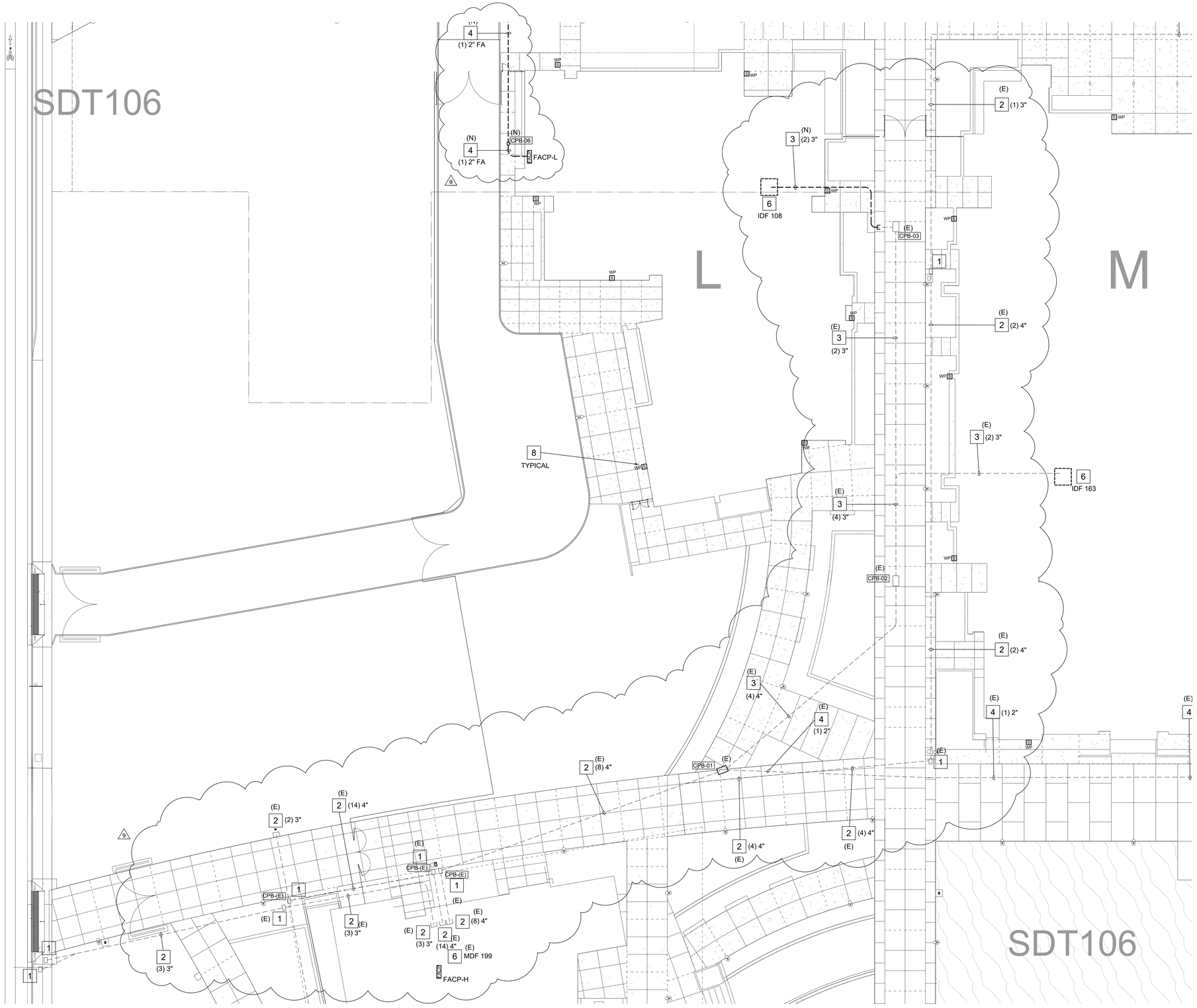
Revision

	Designed By:
Scale: As indicated	Drawn By:
Project Number: 2171	Checked By:
Date: 08/27/24	Reviewed By:

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SD/T101
AD10

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PARTIAL SITE COMMUNICATIONS PLAN

SCALE: 1"=20'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

1. EXISTING COMMUNICATIONS PULLBOX TO REMAIN, PROTECT IN PLACE.
2. EXISTING COMMUNICATION SYSTEMS CONDUITS TO REMAIN, SIZE AND QUANTITY INDICATED, CONTRACTOR TO CONFIRM EXACT LOCATION AND PROTECT IN PLACE.
3. NEW COMMUNICATION SYSTEMS CONDUITS, SIZE AND QUANTITY INDICATED.
4. NEW FIRE ALARM SYSTEM CONDUIT(S), SIZE AND QUANTITY INDICATED.
5. 11" X 17" PULLBOX.
6. APPROXIMATE LOCATION OF NEW / EXISTING DATA MDF / IDF ROOM, REFER TO COMMUNICATION FLOOR PLANS AND COMMUNICATION RISER DIAGRAM FOR ADDITIONAL INFORMATION.
7. WEATHERPROOF TELECOM ENCLOSURE FOR ACTIVE NETWORK EQUIPMENT.
8. FIRE ALARM DEVICE ON BUILDING EXTERIOR.

NOTES:
CONTRACTOR SHALL NOT ROUTE CONDUITS THROUGH ANY AREAS PLANNED FOR BUILDINGS / OR FLATWORK INDICATED AS BID ALTERNATES, REFER TO ARCHITECTURAL PLANS FOR EXACT LIMITS OF WORK BOUNDARIES ASSOCIATED WITH EACH BID ALTERNATE. PROVIDE ROUTING OF CONDUITS AS REQUIRED TO CLEAR AREAS DESIGNATED AND ASSOCIATED WITH EACH BID ALTERNATE AND FUTURE BUILDING FOOTPRINTS.
CONTRACTOR TO PROVIDE SHOP DRAWING OF ALL PROPOSED CONDUIT ROUTING ON SITE, FOR ARCHITECT AND ENGINEER REVIEW PRIOR TO INSTALLATION OF ANY WORK.

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Architect

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Revision

	Designed By:	Copyright 2021 Darden Architects
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GENERAL ELECTRICAL NOTES

1. CODE COMPLIANCE: ALL WORK SHALL CONFORM TO AND BE PERFORMED IN ACCORDANCE WITH CODES, STANDARDS, AND ORDINANCES AS SET FORTH BY THE AUTHORITIES HAVING JURISDICTION AND THEIR LATEST ADOPTED EDITIONS (IN EFFECT AT TIME OF BUILDING PERMIT APPLICATION) OF THE FOLLOWING PUBLICATIONS:

   A. CALIFORNIA CODE OF REGULATIONS TITLE 24; INCLUDES 2019 CALIFORNIA ELECTRICAL CODE, 2019 CALIFORNIA FIRE CODE, 2019 CALIFORNIA BUILDING CODE, ETC. WITH LOCAL AMENDMENTS AS APPLICABLE.

   B. AMERICANS WITH DISABILITIES ACT (ADA).

2. SAFETY: THE ELECTRICAL CONTRACTOR IS RESPONSIBLE TO MAINTAIN ALL EQUIPMENT IN A SAFE AND RESPONSIBLE MANNER. KEEP DEAD FRONT EQUIPMENT IN PLACE WHILE EQUIPMENT IS ENERGIZED. CONDUCT ALL CONSTRUCTION OPERATIONS IN A SAFE MANNER FOR EMPLOYEES AS WELL AS OTHER WORKPERSONS OR ANYONE VISITING THE JOB SITE. PROVIDE BARRIERS, FLAGS, TAPE, ETC. AS REQUIRED FOR SAFETY. THE CONTRACTOR SHALL HOLD ALL PARTIES HARMLESS OF NEGLIGENT SAFETY PRACTICES, WHICH MAY CAUSE INJURY TO OTHERS ON OR NEAR THE JOB SITE.

3. FIRE RATED ASSEMBLIES SHALL MAINTAIN RATINGS AS SPECIFIED IN THE CALIFORNIA BUILDING CODE CHAPTER 7. CONTRACTOR SHALL PROVIDE AND INSTALL PHYSICAL ENCLOSURE AROUND FIXTURES, PANELS, ETC. AS REQUIRED. ALL ASSEMBLIES TO BE PENETRATED SHALL BE INSTALLED WITH APPLICABLE THROUGH-PENETRATION FIRESTOP SYSTEM AS DETERMINED BY UL CLASSIFICATION. BEFORE CONSTRUCTION, VERIFY AND COMPLY WITH REQUIREMENTS OF LOCAL AUTHORITY HAVING JURISDICTION.

4. MOUNTING HEIGHTS SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED:

   +15" AFF: RECEPTACLES, TELEPHONE, TV & DATA OUTLET BOX. (MEASURED BOTTOM OF OUTLET BOX)
   +44" OR 46" AFF: OUTLET BOX ABOVE COUNTER (MEASURED TOP OF OUTLET BOX).
   +48" AFF: LIGHT SWITCH OUTLET BOX. (MEASURED TOP OF OUTLET BOX)
   +48" AFF: FIRE ALARM MANUAL PULL STATIONS, T-STATS. OUTLET BOX (MEASURED TOP OF OUTLET BOX)
   THE LOWER OF +80" AFF TO BOTTOM OF LENS, OR 6" BELOW CEILING: FIRE ALARM VISUALS.

   ELECTRICAL SWITCHES: CONTROLS AND SWITCHES INTENDED TO BE USED BY THE OCCUPANT OF THE ROOM OR AREA TO CONTROL LIGHT AND RECEPTACLE OUTLETS, APPLIANCES OR COOLING, HEATING AND VENTILATING EQUIPMENT, SHALL BE LOCATED NO MORE THAN 48 INCHES MEASURED FROM THE TOP OF THE OUTLET BOX NOR LESS THAN 15 INCHES MEASURED FROM THE BOTTOM OF THE OUTLET BOX TO THE LEVEL OF THE FINISH FLOOR OR WORKING PLATFORM. [CBC 11B-308.1.1]

   ELECTRICAL RECEPTACLE OUTLETS: ELECTRICAL RECEPTACLE OUTLETS ON BRANCH CIRCUITS OF 30 AMPERES OR LESS AND COMMUNICATION SYSTEM RECEPTACLES SHALL BE LOCATED NO MORE THAN 48 INCHES MEASURED FROM THE TOP OF THE RECEPTACLE OUTLET BOX OR RECEPTACLE HOUSING NOR LESS THAN 15 INCHES MEASURED FROM THE BOTTOM OF THE RECEPTACLE OUTLET BOX OR RECEPTACLE HOUSING TO THE LEVEL OF THE FINISH FLOOR OR WORKING PLATFORM [CBC 11B-308.1.2]

   BEFORE ROUGH-IN, VERIFY ALL MOUNTING HEIGHTS AND EXACT LOCATIONS FOR ALL EQUIPMENT ELECTRICAL CONNECTIONS, STUB-UPS, RECEPTACLES, OUTLETS, ETC. WITH ARCHITECT OR OWNER. PLACE DEVICES LOCATED ABOVE COUNTERS, SHELVING, ETC. AND IN BATHROOMS SO AS NOT TO CONFLICT WITH EDGES OF WAINSCOTING, COUNTER SPLASH, SHELVING, ETC. ARCHITECTURAL SHEETS SHALL GOVERN.

5. LABEL PANELS, CABINETS, BACKBOARDS, MAIN DEVICES, SAFETY SWITCHES, CONTACTORS AND OTHER SPECIFICALLY DESIGNATED EQUIPMENT SHOWN ON PLANS. USE ENGRAVED LAMINATED PLASTIC NAMEPLATES ATTACHED BY SCREWS OR RIVETS. FOR FEEDERS, NEATLY AND INDELIBLY LABEL CONDUIT DESTINATIONS ON BOTH VISIBLE ENDS OF CONDUIT RUNS WHERE CONDUITS TERMINATE AT DESIGNATED ENCLOSURES, STRUCTURES OR EQUIPMENT (INCLUDING PULL AND SPLICE BOXES).

6. MEP COMPONENT ANCHORAGE NOTE

ALL MECHANICAL, PLUMBING AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2019 CBC, SECTIONS 1617A.1.18 THROUGH 1617A 1.26 AND ASCE 7-16 CHAPTERS 13, 26 & 30:

A. ALL PERMANENT EQUIPMENT AND COMPONENTS.

B. TEMPORARY, MOVABLE OR MOBILE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER. 'PERMANENTLY ATTACHED' SHALL INCLUDE ALL ELECTRICAL CONNECTION EXCEPT PLUGS FOR 110/220 VOLT RECEPTACLES HAVING A FLEXIBLE CABLE.

C. TEMPORARY, MOVABLE OR MOBILE EQUIPMENT WHICH IS HEAVIER THAN 400 POUNDS OR HAS A CENTER OF MASS LOCATED 4 FEET OR MORE ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT IS REQUIRED TO BE RESTRAINED IN A MANNER APPROVED BY DSA.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE BUT NEED NOT DEMONSTRATE DESIGN COMPLIANCE WITH THE REFERENCES NOTED ABOVE. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING AND CONDUIT. FLEXIBLE CONNECTIONS MUST ALLOW MOVEMENT IN BOTH TRANSVERSE AND LONGITUDINAL DIRECTIONS:

A. COMPONENTS WEIGHTING LESS THAN 400 POUNDS AND HAVE A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.

B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN CASE OF DISTRIBUTED SYSTEMS, LESS THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

THE ANCHORAGE OF ALL MECHANICAL, ELECTRICAL AND PLUMBING COMPONENTS SHALL BE SUBJECT TO THE APPROVAL OF THE DESIGN PROFESSIONAL IN GENERAL RESPONSIBLE CHARGE OR STRUCTURAL ENGINEER DELEGATED RESPONSIBILITY AND ACCEPTANCE BY DSA. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-16 SECTION 13.3 AS DEFINED IN ACSE 7-16 SECTION 13.6.5, 13.6.6, 13.6.7, 13.6.8, AND 2019 CBC SECTIONS 1617A.1.24, 1617A.1.25 AND 1617A.1.26.

THE METHOD OF SHOWING BRACING AND ATTACHMENTS TO THE STRUCTURE FOR THE IDENTIFIED DISTRIBUTION SYSTEMS ARE NOTED BELOW. WHEN BRACING AND ATTACHMENTS ARE BASED ON A PRE-APPROVED INSTALLATION GUIDE (E.G., OSHPD, OPM FOR 2013 CBC OR LATER), COPIES OF THE BRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE SHALL BE ON THE JOBSITE PRIOR TO START OF HANGING AND BRACING OF THE DISTRIBUTION SYSTEMS. THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE AS DETAILED ON THE APPROVED DRAWINGS WITH PROJECT SPECIFIC NOTES AND DETAILS, REFER TO DETAILS ON SHEETS X/E202, X/E203, X/E204, X/E205, X/E206, X/E207.

7. PULLROPES: ANY RACEWAY WITHOUT CABLE OR WIRE SHALL BE INSTALLED WITH MINIMUM 200 POUND TEST PULL LINE AND LARGER IF REQUIRED BY SERVING UTILITY COMPANY. ANY NEW OR EXISTING COMMUNICATION OR SIGNAL RACEWAY ROUTED BETWEEN BUILDINGS, SIGNAL CABINETS, AND/OR SIGNAL CLOSETS WITH FUTURE CAPACITY SHALL BE INSTALLED WITH MINIMUM 200 POUND TEST PULL LINE AS WELL AS THE CALLED FOR CABLE.

8. CONDUIT SHALL NOT BE INSTALLED WITHIN CONCRETE SLABS OR CONCRETE DECKS UNLESS SPECIFICALLY NOTED.

MECHANICAL SYSTEMS

1. MECHANICAL UNIT CONDUITS: TO PREVENT DAMAGE DUE TO VIBRATION, BOTH POWER AND CONTROL WIRING CONDUITS FEEDING EXTERIOR MECHANICAL UNITS SHALL BE PROVIDED AND INSTALLED WITH LIQUID-TIGHT FLEXIBLE METALLIC TYPE CONDUIT AT FINAL CONNECTION TO UNIT AND BETWEEN ROOF JACK AND DISCONNECT SWITCH WHERE DISCONNECT IS MOUNTED ON UNIT.

2. MECHANICAL CONTROLS RACEWAYS: MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE AS REQUIRED IN ACCORD WITH SECTION 26 0533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS. INCLUDING BUT NOT LIMITED TO: J-BOXES, RINGS, CONDUIT AND SUPPORTS (SIZE ALL AS REQUIRED).

3. EXHAUST FANS SHALL BE PROVIDED & INSTALLED BY MECHANICAL CONTRACTOR WITH WIRING CONNECTIONS MADE BY ELECTRICAL CONTRACTOR.

4. MECHANICAL EQUIPMENT CONTROLS: MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LOW VOLTAGE WIRE AND CONNECTIONS (BELOW 120 VOLT) TO AND FROM ALL MECHANICAL CONTROL DEVICES. LOW VOLTAGE CONTROL WIRE SHALL BE IN CONDUIT, UNLESS OTHERWISE NOTED (REFERENCE SECTION 23 0900 - BUILDING CONTROL SYSTEM).

5. PULLROPES: ANY RACEWAY WITHOUT CABLE OR WIRE SHALL BE INSTALLED WITH MINIMUM 200 POUND TEST PULL LINE AND LARGER IF REQUIRED BY SERVING UTILITY COMPANY. ANY NEW OR EXISTING COMMUNICATION OR SIGNAL RACEWAY ROUTED BETWEEN BUILDINGS, SIGNAL CABINETS, AND/OR SIGNAL CLOSETS WITH FUTURE CAPACITY SHALL BE INSTALLED WITH MINIMUM 200 POUND TEST PULL LINE AS WELL AS THE CALLED FOR CABLE.

CALIFORNIA GREEN CODE GENERAL NOTES

- CONTRACTOR TO INCLUDE PARTICIPATION IN THIRD PARTY COMMISSIONING AND BUILDING TESTING/COMMISIONING AS REQUIRED BY CAL GREEN CODE. REFER TO PROJECT COMMISSION SPECIFICATIONS FOR FURTHER INFORMATION. SUPPORT SERVICES ASSOCIATED WITH BUILDING COMMISSIONING INCLUDE BUT ARE NOT LIMITED TO: DEMONSTRATING SYSTEM PERFORMANCE, PRE AND POST INSTALLATION DOCUMENTATION OF LIGHTING CONTROL SYSTEMS COMPONENT INSTALLATION, ADJUSTING LIGHTING CONTROL EQUIPMENT SETTINGS AS DIRECTED FOR OPTIMUM PERFORMANCE AND OWNER DEFINED TIME SETTINGS.

GENERAL LIGHTING PLAN NOTES

A. LIGHTING FIXTURE LOCATIONS SHOWN ARE SCHEMATIC. REFER TO ARCHITECTURAL PLANS (REFLECTED CEILING, ELEVATIONS, ETC.) FOR EXACT LOCATIONS AND MOUNTING HEIGHTS PRIOR TO ROUGH-IN.

B. COORDINATE MOUNTING HEIGHTS OF WALL AND PENDANT MOUNT LUMINAIRES WITH ARCHITECT PRIOR TO ROUGH-IN.

C. REFER TO ARCHITECT'S REFLECTED CEILING PLAN(S) FOR CEILING HEIGHTS, TYPES, FINISHES, ETC. IN EACH AREA. VERIFY FLANGE TYPES, TRIM KITS, STEM LENGTHS, ETC. FOR ALL FIXTURES PRIOR TO SUBMITTALS.

D. CONFIRM LOCATION OF ALL DOORS SWINGS WITH ARCHITECTURAL PLANS PRIOR TO ROUGH-IN OF SWITCHES.

E. PROVIDE UNSWITCHED HOT LEG OF ROOM LIGHTING BRANCH CIRCUIT TO EACH BATTERY POWERED EMERGENCY LIGHT AND EXIT SIGN FOR CONTINUOUS CHARGING (AS APPLICABLE). 9

GENERAL POWER PLAN NOTES

A. INSTALL SEPARATE NEUTRALS FOR EACH BRANCH CIRCUIT.

B. DEVICE LOCATIONS SHOWN ARE SCHEMATIC AND APPROXIMATE. EXACT LOCATIONS SHALL BE FIELD VERIFIED DURING ROUGH-IN WITH ARCHITECT, DISTRICT REPRESENTATIVE, ARCHITECTURAL ELEVATIONS, CASEWORK SHOP DRAWINGS, FURNITURE, ETC. AND SHALL BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICT WITH OTHER EQUIPMENT.

C. ELECTRICAL AND COMMUNICATIONS OUTLETS SHOWN IN FIRE RATED, OR SOUND RATED (STC) ASSEMBLIES SHALL BE PROVIDED WITH PUTTY PADS LISTED FOR THE APPLICATION.

D. ELECTRICAL AND COMMUNICATIONS OUTLETS SHOWN IN THE SAME LOCATION, SHALL BE MOUNTED ON OPPOSITE SIDES OF THE SAME STUD. COORDINATE BETWEEN ELECTRICAL AND COMMUNICATIONS PLANS. ALTERNATIVELY, A DEVICE BRACKET MAY BE USED BETWEEN STUDS WITH 4-INCH SEPARATION BETWEEN POWER AND LOW VOLTAGE BOXES.

E. CONTROLLED RECEPTACLES; INSTALLED PER REQUIREMENTS OF 2019 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-WIRED', SO THE TOP OUTLET SHALL BE SWITCHED AND THE BOTTOM OUTLET SHALL BE UNSWITCHED. A DOUBLE DUPLEX (FOURPLEX) NOTED TO BE CONTROLLED SHALL HAVE ONE OF THE DUPLEX RECEPTACLES SHALL BE CONTROLLED AND THE OTHER DUPLEX RECEPTACLE SHALL BE UNSWITCHED.

F. WHERE OUTLETS ARE SHOWN TO BE MOUNTED ABOVE COUNTER / CASEWORK, PLACE BOTTOM OF OUTLETS 1" ABOVE COUNTER / CASEWORK BACKSPLASH.

GENERAL COMMUNICATION PLAN NOTES

A. REFER TO PROJECT TELECOMMUNICATIONS PLANS AND SPECIFICATIONS FOR COMMUNICATIONS SYSTEMS REQUIREMENTS.

B. RACEWAYS INSTALLED FOR TELECOMMUNICATIONS SHALL CONFORM WITH APPLICABLE DIVISION 26 SPECIFICATIONS.

C. ALL TELECOMMUNICATIONS CONDUITS SHALL HAVE PULLSTRINGS INSTALLED FROM END-TO-END.

D. ALL WORK SHOWN IS NEW UNLESS NOTED OTEHRWISE.

GENERAL ROOF PLAN NOTES

A. PROVIDE METALLIC SEALTITE POWER & CONTROL CONNECTIONS TO ALL AC UNITS.

B. ALL EQUIPMENT SHOWN ABOVE ROOF IS NEMA 3R.

C. VERIFY EXACT EQUIPMENT LOCATIONS AND POINTS OF CONNECTION WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.

D. CONDUIT SHOWN ON ALL ROOF PLANS SHALL BE ROUTED IN CEILING SPACE BELOW ROOF DECK.

E. NO ROOF MOUNT CONDUIT IS ALLOWED.

F. FUSE DISCONNECT SWITCHES PER EQUIPMENT NAMEPLATE RATING.

G. ALL ROOF PENETRATIONS SHALL BE MADE WITH ROOF JACKS, SEAL ALL PENETRATIONS WITH MASTIC, REFER TO ARCHITECTURAL ROOFING DETAILS.

H. REFER TO TYPICAL ARCHITECTURAL DETAILS FOR ROOF PENETRATION DETAILS, PROVIDE A TRADE COORDINATION MEETING FOR THE PLACEMENT OF ALL ROOF PENETRATIONS AND DECK OPENINGS.

GENERAL ELECTRICAL EQUIPMENT NOTES

A. ALL EQUIPMENT FURNISHED FOR THIS PROJECT SHALL BE PROVIDED WITH MANUFACTURER'S SPECIAL SEISMIC CERTIFICATION (OSP #) AS REQUIRED BY AHJ.

TYPICAL CLASSROOM MOCK-UP NOTES

A. CONTRACTOR TO PROVIDE A SAMPLE MOCK-UP OF A TYPICAL CLASSROOM FOR ALL EQUIPMENT TO BE INSTALLED IN A TYPICAL CLASSROOM AS PART OF THESE DRAWINGS, INCLUDING SUPPORTING PATHWAYS FOR OWNER AND ARCHITECT REVIEW AND ACCEPTANCE. NO EQUIPMENT OR PATHWAYS SHALL BE INSTALLED UNTIL MOCK-UP HAS BEEN REVIEWED AND APPROVED.

B. CONTRACTOR TO PROVIDE A SAMPLE MOCK-UP OF A TYPICAL SCIENCE CLASSROOM FOR ALL EQUIPMENT TO BE INSTALLED IN A TYPICAL SCIENCE CLASSROOM AS PART OF THESE DRAWINGS, INCLUDING SUPPORTING PATHWAYS FOR OWNER AND ARCHITECT REVIEW AND ACCEPTANCE. NO EQUIPMENT OR PATHWAYS SHALL BE INSTALLED UNTIL MOCK-UP HAS BEEN REVIEWED AND APPROVED.

CONTRACTOR COORDINATION NOTE

A. CONTRACTOR TO REVIEW ARCHITECTURAL, MECHANICAL, PLUMBING, CIVIL, THEATRICAL LIGHTING, AUDIO VISUAL, FIRE PROTECTION, FOOD SERVICE DRAWINGS AND SPECIFICATIONS INCLUDED AS PART OF THIS PROJECT, CONFIRM ALL REQUIRED ELECTRICAL, INTERLOCKING, DATA DISTRIBUTION AND FIRE ALARM CONNECTIONS AND INCLUDE IN BID. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

DISPLAY MONITOR NOTE

3

A. AT DISPLAY MONITORS, POWER, DATA, HDMI PASSTHRU SHALL BE INSTALLED ABOVE THE MONITOR AT +84" AND BELOW AT +15", TYPICAL AT ALL MONITOR LOCATIONS, REFER TO ARCHITECTURAL PLANS FOR MONITOR LOCATIONS. CONTRACTOR SHALL REVIEW THE PLANS WITH THE DISTRICT BEFORE THE PATHWAYS ARE INSTALLED AND CONFIRM THE LOCATION AND HEIGHTS OF ALL DEVICES.

CIRCUITING LEGEND

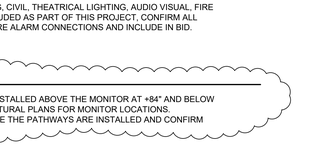
LIGHTING PLAN



- PROVIDE ALL BRANCH CIRCUIT WIRING FROM FIXTURES TO PANEL(S) AS DESIGNATED CIRCUIT NUMBERS SHOWN.
- BRANCH CIRCUITS SHALL HAVE A SEPARATE NEUTRAL .
- PROVIDE ALL WIRING BETWEEN FIXTURES AND CONTROL DEVICES AND/OR LOW VOLTAGE CONTROL CABLING AS DESCRIBED IN REFERENCE NOTES AND/OR SHOWN BY SWITCHLEG DESIGNATIONS.
- FLEXIBLE CONDUIT WHIPS, MAY BE USED TO CONNECT LIGHTS TO JUNCTION BOX.
- BRANCH WIRING WITHIN ROOM SHALL BE 3/4" CONDUIT MINIMUM,WITH MAX. 40% FILL INCLUDING HOTS, SWITCH LEGS AND 0-10V CONDUCTORS.
- HOME RUN CONDUITS SHALL BE 3/4" CONDUIT MINIMUM, MAXIMUM OF (3) BRANCH CIRCUITS PER CONDUIT.

NOTE:
FOR CLARIFICATION, SOME HOMERUNS HAVE NOT BEEN SHOWN ON THE DRAWINGS, CONTRACTOR TO PROVIDE ALL REQUIRED HOMERUNS, REFER TO SINGLE LINE DIAGRAMS AND PANEL SCHEDULES FOR ALL CONDUCTORS SIZES.

POWER PLAN



- PROVIDE ALL BRANCH CIRCUIT WIRING FROM DEVICES TO PANELS PER DESIGNATIONS/CIRCUIT NUMBERS.
- BRANCH CIRCUITS SHALL HAVE A SEPARATE NEUTRAL .
- HOME RUN CONDUITS SHALL BE 3/4" MINIMUM, MAXIMUM OF (3) BRANCH CIRCUITS PER CONDUIT.

NOTE: SEE GENERAL ELECTRICAL NOTE 4 FOR WIRING DEVICE MOUNTING HEIGHTS

NOTE:
FOR CLARIFICATION, SOME HOMERUNS HAVE NOT BEEN SHOWN ON THE DRAWINGS, CONTRACTOR TO PROVIDE ALL REQUIRED HOMERUNS, REFER TO SINGLE LINE DIAGRAMS AND PANEL SCHEDULES FOR ALL CONDUCTORS SIZES.

LEGEND

NOTE: INTERPRET IN CONTEXT

NOTE: SEE GENERAL ELECTRICAL NOTE 4 FOR WIRING DEVICE MOUNTING HEIGHTS

LIGHT FIXTURES

- CEILING SURFACEMOUNT
- WALL SURFACEMOUNT
- PENDANT MOUNT
- RECESSED DOWNLIGHT
- RECESSED WALLWASH
- RECESSED FLUOR.
- SURFACE FLUOR.
- FLUOR. STRIP UON
- TRACK LIGHT
- DIRECTIONAL FLOOD
- EMERGENCY FIXTURE
- POLE LIGHT
- POLE LIGHT- DECORATIVE
- UPLIGHT- FLUSH IN GRADE
- BOLLARD
- TANDEM-WIRED LAMPS
- UNDERCABINET LIGHT
- WALL/SURFACEMOUNT LINEAR TYPE
- PENDANT LINEAR FLUOR.
- RECESSED WALLMOUNT
- WALLPACK
- WALL MOUNTED EXIT LIGHT ON EMERGENCY BRANCH CIRCUIT
- CEILING MOUNTED EXIT LIGHT ON EMERGENCY BRANCH CIRCUIT (ARROW INDICATES DIRECTION)
- A — LETTER ADJACENT INDICATES FIXTURE TYPE
- AE — SHADED LIGHT SYMBOL & "EM"/(EM) DESIGNATION INDICATES EMERGENCY FIXTURE ON EMERGENCY BRANCH CIRCUIT

MISCELLANEOUS

- MOTOR
- THERMOSTAT
- CIRCUIT BREAKER
- FUSIBLE SWITCH
- GROUND
- Ø PHASE
- PUSHBUTTON
- FLUSHMOUNT PANEL
- SURFACEMOUNT PANEL
- FLUSHMOUNT CABINET
- SURFACEMOUNT CABINET
- TRANSFORMER
- DAMPER MOTOR
- H HUMIDISTAT
- M MAGNETIC CONTACTOR
- COMBINATION STARTER
- J^MC ABOVE-CLG J-BOX FOR MECHANICAL CONTROL POWER
- EMERG. NOTIFICATION DOME LT.
- T LOW VOLTAGE TRANSFORMER
- GROUND BUS BAR

POWER.

- TAMPER RESISTANT DUPLEX RECEPTACLE
- DOUBLE DUPLEX RECEPTACLE
- GFCI (GFCI) GROUND FAULT CURRENT INTERRUPTER DEVICE
- MOUNT ABOVE COUNTER PER ADA. REFER TO ARCH.
- MOUNT AT +48" MEASURED TO TOP OF BOX.
- WP NEMA 3R COVER (BELL # 1503 OR ENGINEER APROVED EQUAL),
- 208V RECEPTACLE
- WIU WHILE-IN USE NEMA 3R COVER (TAYMAC #MX4280S OR ENGINEER APROVED EQUAL), UON.
- FLOOR MOUNTED OUTLET
- "CONTROLLED" DUPLEX RECEPTACLE PER 2019 CA ENERGY CODE REQUIREMENTS 130-5 "CIRCUIT CONTROLS FOR 120V RECEPTACLES"
- (1)CONTROLLED DUPLEX RECEPTACLE AND (1) DUPLEX RECEPTACLE
- DUPLEX RECEPTACLE. REMOVE BREAK-OFF TAB. TOP OUTLET IS CONTROLLED AND BOTTOM OUTLET IS UN-CONTROLLED. CONTROLLED OUTLET SHALL HAVE A PERMANENT MARKING TO DIFFERENTIATE THEM FROM UNCONTROLLED OUTLET PER 2019 CA ENERGY CODE REQUIREMENTS.
- D DEDICATED OUTLET
- C CEILING MOUNTED OUTLET
- SPD SURGE PROTECTION DEVICE
- SFD SMOKE FIRE DAMPER
- IG ISOLATED GROUND TYPE RECEPTACLE

NOTE (CR):
- CONTROLLED RECEPTACLES SHALL BE PERMANENTLY MARKED PER CENC 130.5 (TITLE 24).
- WHERE A DUPLEX IS NOTED TO BE CONTROLLED, 'SPLIT-WIRED', SO THE TOP OUTLET SHALL BE SWITCHED AND THE BOTTOM OUTLET SHALL BE UNSWITCHED.
- WHERE A DOUBLE DUPLEX IS NOTED TO BE CONTROLLED, ONE OF THE DUPLEX RECEPTACLES SHALL BE CONTROLLED AND THE OTHER DUPLEX RECEPTACLE SHALL BE UNSWITCHED.

SWITCHES

- $ SPST
- $2 DPST
- $3 3-WAY
- $4 4-WAY
- $D DIMMER
- $T TIMER SWITCH
- $T W/THERMAL OVERLOAD
- $P W/PILOT LIGHT
- $K KEY OPERATED
- $$ DUAL LEVEL SWITCHING
- ,a SWITCHLEG DESIGNATION

CONVENTIONS

- X — NUMBERED SHEET NOTES: REFERS TO NOTES ON SAME SHEET AS REFERENCED
- 1 / - — DETAIL REFERENCE: -DETAIL DESIGNATION -SHEET NUMBER REFERENCE
- 3103 — FEEDER SCHEDULE DESIGNATION (EXAMPLE: 3103 = 310 AMPERE, 600V, 3 CURRENT CARRYING CONDUCTORS, - 'CO14' INDICATES CONDUIT ONLY, QUANTITY (1) AND SIZE (4")).
- UNIT # — HVAC EQUIPMENT TAG
- PLUMB-1 — PLUMBING EQUIPMENT TAG

CONDUIT/WIRE

- NEW
- UNDERGROUND
- NEW POWER HOMERUN (3 HOTS & NEUT SHOWN)
- ISOLATED GROUND
- EXISTING TO REMAIN
- (E) POWER HOMERUN
- WIRE LINE- CONTINUES
- CONDUIT STUB (W/MARKER)
- VERTICAL CONDUIT RUN
- CONDUIT SEAL
- FLEXIBLE CONNECTION
- LOW VOLTAGE
- SURFACEMOUNT RACEWAY
- INDICATES LINE CONTINUES
- CORD W/PLUG

FIRE ALARM (ALSO SEE SHT. X/E500) 9

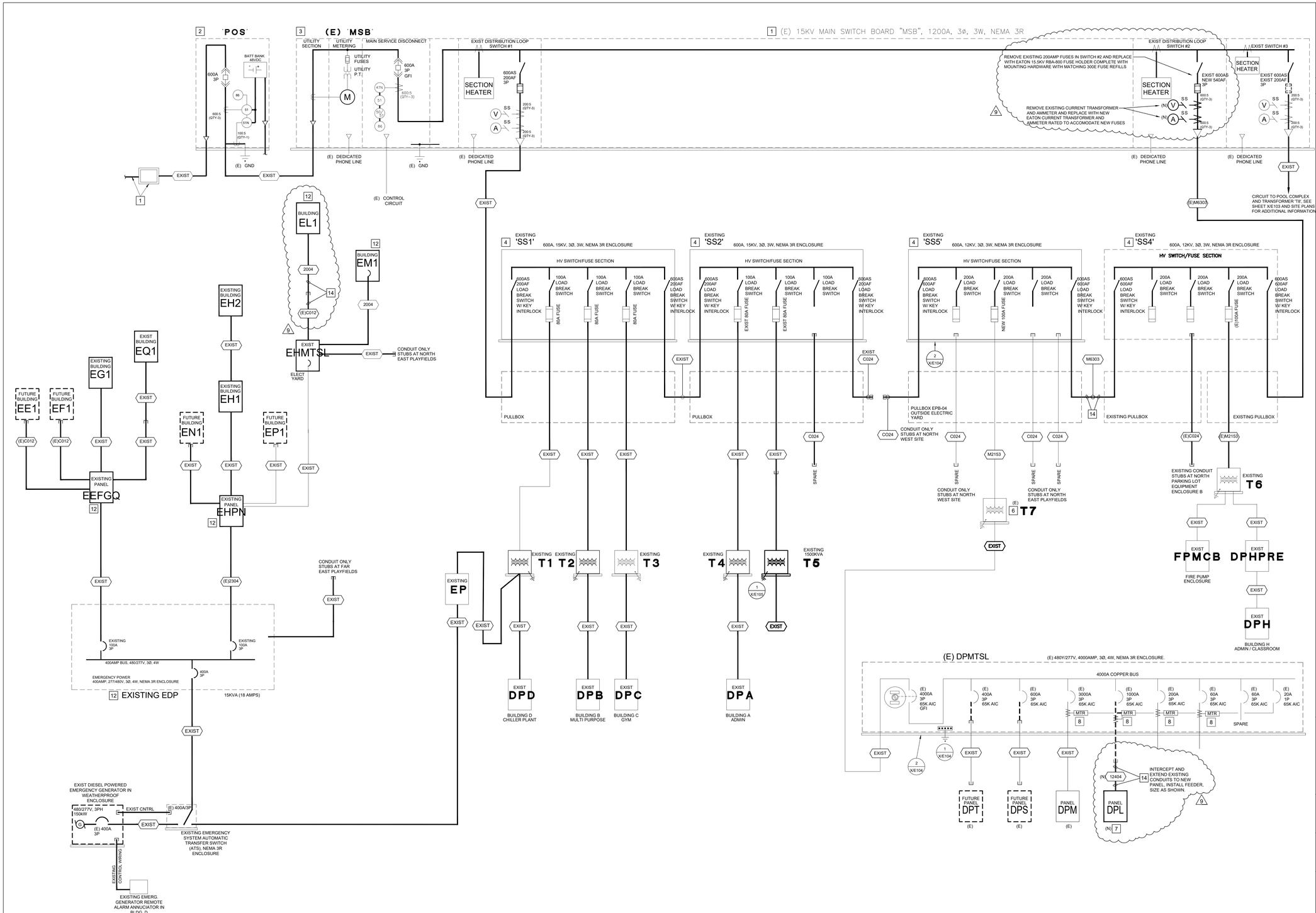
- FACP FIRE ALARM CONTROL PANEL
- RPS REMOTE POWER SUPPLY
- H HORN- AUDIBLE DEVICE
- V VISUAL DEVICE
- V_C VISUAL - DEVICE-CEILING MOUNTED
- AV AUDIBLE (HORN) / VISUAL (STROBE)
- AV_C AUDIBLE/VISUAL-CEILING MOUNTED
- SV AUDIBLE (SPEAKER) / VISUAL (STROBE)
- SV_C AUDIBLE/VISUAL-CEILING MOUNTED
- S AUDIBLE (SPEAKER)
- F FLOW SWITCH
- T TAMPER SWITCH
- P MANUAL PULL STATION
- P_TP PULL STATION TAMPER PROOF (RESISTANT)
- SD SMOKE DETECTOR
- SD_D DUCT SMOKE DETECTOR
- H HEAT DETECTOR
- B BELL
- END OF LINE RESISTOR
- C CHIME

SOUND/CLOCK

- S SPEAKER- CLG FLUSHMOUNT
- S SPEAKER- WALLMOUNT
- M MICROPHONE INPUT
- A AUXILIARY INPUT
- IC INTERCOM, WALL MOUNT
- HS HEADSET OUTLET
- V VOLUME CONTROL
- VS SPEAKER- CLG FLUSHMOUNT VANDAL-RESISTANT
- S CLOCK/SPEAKER WALLMOUNT SEMI-FLUSH

ABBREVIATIONS

0-10V	ZERO TO TEN VOLT CONTROL	FACP	FIRE ALARM CONTROL PANEL	OCP	OVERCURRENT PROTECTION
A	AMPERE	FAT	FIRE ALARM TERMINAL	OD	OUTSIDE DIAMETER
AB	AMP BREAKER	FAU	FORCED AIR UNIT	OFOI	OWNER FURNISHED OWNER INSTALLED
ABAND	ABANDONED	FBO	FURNISHED BY OTHERS	OH	OVERHEAD
ABV	ABOVE	FC-#	FAN COIL	ODU	OUTDOOR UNIT
AC	ALTERNATING CURRENT	FLA	FULL LOAD AMPS	OVLD	OVERLOAD
AC-#	AIR CONDITIONER	FLR	FLOOR	P	POLE
ADJ	ADJACENT	FLUOR	FLUORESCENT	PA	PUBLIC ADDRESS
AF	AMP FUSE, AMP FRAME	FS	FUSIBLE SWITCH	PB	PULLBOX
AFF	ABOVE FINISH FLOOR	FVNR	FULL VOLTAGE NON-REVERSING	PC	PULL CHAIN
AFG	ABOVE FINISH GRADE	G	GROUNDING CONDUCTOR	PC	PHOTOCELL
AIC	AMPERES INTERRUPTING CAPACITY	GC	GENERAL CONTRACTOR	PC	PLUMBING CONTRACTOR
AI	ALUMINUM	GD	GARBAGE DISPOSAL	PLD	PRODUCTION LIGHTING DEVICE
AS	AMP SWITCH RATING	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	ph	PHASE
		GFI	GROUND FAULT CIRCUIT INTERRUPTER	PNL	PANEL
ATS	AUTOMATIC TRANSFER SWITCH	GND	GROUND	POC	POINT OF CONNECTION
AV	AUDIBLE/AUDIO VISUAL	GRS	GALVANIZED RIGID STEEL	-PP-	POWER PRIMARY
AWG	AMERICAN WIRE GAGE	GWS	GANG WITH SWITCH	-PS-	POWER SECONDARY
BFG	BELOW FINISH GRADE	H	HEIGHT, HIGH	PV	PHOTOVOLTAIC
BIL	BASIC IMPULSE LEVEL	HACR	HEATING, AC & REFRIG	(R)	RELOCATE(D)
BKBD	BACKBOARD	HID	HIGH INTENSITY DISCHARGE	RECEPT	RECEPTACLE
BLDG	BUILDING	HO	HIGH OUTPUT	REF	REFRIGERATOR
C	CONDUIT	HOA	HAND-OFF-AUTO	REX	REQUEST TO EXIT
-C-	CATV CONDUIT	hp	HORSEPOWER	REQ'D	REQUIRED
CAB'T	CABINET	HPF	HIGH POWER FACTOR	RGBW	RED, GREEN, BLUE, WHITE
CATV	CABLE TELEVISION	HPS	HIGH PRESSURE SODIUM	RLA	RATED LOAD AMPS
CB	CIRCUIT BREAKER, CODE BLUE	IC	INTERCOM	RM	ROOM
CBC	CA. BUILDING CODE	ID	IDENTIFICATION	RMC	RIGID METAL CONDUIT
CEC	CA. ELECTRICAL CODE	IDF	INTERMEDIATE DISTRIBUTION FRAME	RMV	REMOVE
	CA. ENERGY COMMISSION	IDU	INDOOR UNIT	RPLC	REPLACE
CF	COMPACT FLUORESCENT	IG	ISOLAT



MEDIUM VOLTAGE AND EMERGENCY DISTRIBUTION SINGLE LINE DIAGRAM - OVERALL SITE

NTS

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

1. EXISTING 12KV PG&E PRIMARY SERVICE, EXISTING UTILITY COMPANY SHORT CIRCUIT RATING - 2.8kA, CONTACT PG&E AND VERIFY EXISTING SHORT CIRCUIT RATING AND USE AS BASIS FOR OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY.
2. EXISTING PG&E PAD MOUNTED LOAD INTERRUPTER / POINT OF SERVICE 'POS' EQUIPMENT.
3. EXISTING CAMPUS PRIMARY METERED MAIN SWITCHBOARD 'MSB'
4. PAD MOUNTED MEDIUM VOLTAGE FUSIBLE SECTIONALIZING SWITCH WITH CURRENT LIMITING FUSES, EXISTING OR NEW AS INDICATED.
5. PULLBOX AT SWITCH, SEE SITE PLANS.
6. PADMOUNT MEDIUM VOLTAGE STEPDOWN TRANSFORMER WITH DOUBLE LUGS (AS APPLICABLE), SEE TRANSFORMER SCHEDULE ON SHEET X/E104.
7. DISTRIBUTION PANEL AT EACH BUILDING, TYPICAL.
8. MICROPROCESSOR BASED PRIVATE METERING EQUIPMENT, REFER TO SPECIFICATIONS. CONTROL CIRCUIT/CONTROL POWER AS SHOWN.
9. LIGHTING PANELBOARD.
10. ELECTRIC VEHICLE CHARGING STATION PANELBOARD.
11. DRY TYPE STEP DOWN TRANSFORMER, SEE TRANSFORMER SCHEDULE ON SHEET X/E104.
12. EMERGENCY DISTRIBUTION SYSTEM PANELBOARD.
13. PROVIDE LOCKING DEVICE ON THIS CIRCUIT BREAKER.
14. INTERCEPT, EXTEND AND CONNECT EXISTING CONDUIT(S) TO NEW PANEL / EQUIPMENT AS SHOWN, INSTALL FEEDER THROUGH NEW AND EXISTING CONDUITS, SIZE AS SHOWN.
15. PROVIDE AND INSTALL NEW CIRCUIT BREAKER IN EXISTING DISTRIBUTION PANEL COMPLETE WITH REQUIRED MOUNTING HARDWARE, REARRANGE / REMOVE EXISTING CIRCUIT BREAKERS AS REQUIRED TO PROVIDE SPACE IN PANEL FOR NEW CIRCUIT BREAKER.
16. REFER TO PANEL SCHEDULE FOR ADDITIONAL CIRCUIT BREAKER AND PANEL INFORMATION.
17. PROVIDE CIRCUIT BREAKER WITH LUGS SIZED AS REQUIRED FOR SPECIFIED FEEDER, TYPICAL FOR ALL CIRCUIT BREAKERS.

1. SERVICE ENTRANCE EQUIPMENT SHALL BE IN ACCORDANCE WITH THE SERVING ELECTRIC UTILITY COMPANIES REQUIREMENTS (AS APPLICABLE).
2. ALL CONDUCTORS SHALL BE COPPER.
3. DESIGN SHOWN IS BASED ON EATON PRODUCTS, SCHNEIDER ELECTRICAL IS APPROVED EQUAL.
4. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR SUPPLYING ALL SWITCHGEAR SIZED TO FIT IN AVAILABLE ELECTRIC ROOM SPACE(S), FLUSH MOUNTED IN WALL(S) WHERE SHOWN, AND EQUIPMENT LAYOUTS TO CLEAR ALL BUILDING STRUCTURAL FOOTINGS. REFER TO THE ARCHITECTURAL PLANS FOR DIMENSIONAL INFORMATION AND STRUCTURAL PLANS FOR ADDITIONAL INFORMATION NOT SHOWN ON THE ELECTRICAL PLANS. CONTRACTOR SHALL SUBMIT A 1/4" SCALE DRAWING OF ALL SWITCHGEAR, TERMINATION CABINET(S), ETC., ON FLOOR PLAN OF EACH ELECTRIC ROOM WITH SUBMITTAL.
5. VERIFY ALL FEEDER, AND BRANCH CIRCUIT CONDUCTOR SIZES AND PROVIDE PROPERLY SIZED LUGS FOR ALL BREAKERS AS REQUIRED FOR SPECIFIED CONDUCTORS.

General Notes

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EXPIRES: 06/30/25

Consultant THOMA #22-8060

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1760 S Fowler Ave, Fresno CA 93727

Project

TYPICAL INFORMATION

SINGLE LINE DIAGRAM

Drawing

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LICENSED ARCHITECT RICHARD K. FENDLEY No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

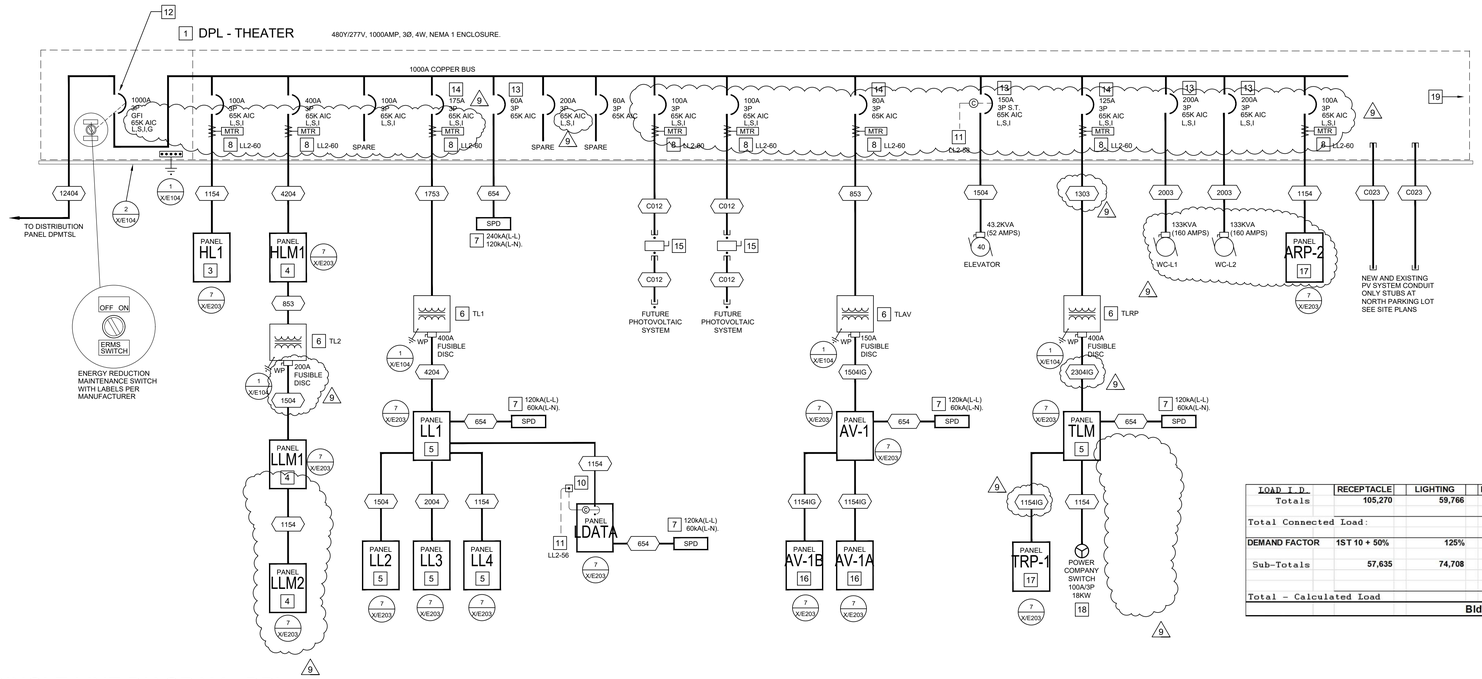
Designed By:
Drawn By:
Checked By:
Reviewed By:

Scale: As indicated
Project Number: 2171
Date: 08/27/24

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X/E101
AD10

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LOAD I D.	RECEPTACLE	LIGHTING	MECHANICAL	FOOD SERV	NON-CONT	CONTINUOUS	
Totals	105,270	59,766	425,308	0	131,150	0	
						AMPS @480V,3Ph	
Total Connected Load:						714,640	859.6
DEMAND FACTOR	1ST 10 + 50%	125%	100%	65%	100%	125%	
Sub-Totals	57,635	74,708	425,308	0	131,150	0	
						AMPS @480V,3Ph	
Total - Calculated Load					VA=	688,801	828.5

Bldg L Electrical Load Summary

SINGLE LINE DIAGRAM - DPL

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

1. SERVICE ENTRANCE RATED DISTRIBUTION PANEL, SIZE AS INDICATED.
2. NOT USED.
3. LIGHTING PANELBOARD.
4. MECHANICAL PANELBOARD.
5. ELECTRICAL PANELBOARD.
6. DRY TYPE STEP DOWN TRANSFORMER, SEE TRANSFORMER SCHEDULE ON SHEET X/E104.
7. MODULAR SURGE PROTECTION DEVICE, RATINGS AS INDICATED, INSTALL PER MANUFACTURERS INSTALLATION INSTRUCTIONS TO MINIMIZE LEAD LENGTH.
8. MICROPROCESSOR BASED PRIVATE METERING EQUIPMENT, REFER TO SPECIFICATIONS. CONTROL CIRCUIT/CONTROL POWER AS SHOWN.
9. NOT USED.
10. SHUNT TRIP PUSHBUTTON, LABEL DATA ROOM POWER SHUT-OFF, SEE ELECTRICAL FLOOR PLAN FOR LOCATION.
11. PROVIDE 120V CONTROL CIRCUIT TO SHUNT TRIP CIRCUIT BREAKER COIL AS REQUIRED.
12. PROVIDE CIRCUIT BREAKER WITH LUGS SIZED AS REQUIRED FOR SPECIFIED FEEDER, TYPICAL FOR ALL CIRCUIT BREAKERS.
13. VERIFY CIRCUIT BREAKER SIZE AND REQUIRED AUXILIARY OPTIONS WITH SERVING EQUIPMENT APPROVED SUBMITTALS AND SERVING EQUIPMENT MANUFACTURER PRIOR TO PURCHASING EQUIPMENT.
14. PROVIDE LOCKING DEVICE ON THIS CIRCUIT BREAKER.
15. FUTURE PHOTOVOLTAIC SYSTEM DISCONNECT SWITCH.
16. AUDIO/VISUAL PANELBOARD. LYNTEC MFG, INC. MODEL RPC MOTORIZED BREAKER, REFER TO AUDIO/VISUAL DRAWINGS AND SPECIFICATIONS FOR PANEL INFORMATION.
17. ETC INC. MODEL ECHO RELAY/BREAKER PANEL REFER TO PRODUCTION LIGHTING DRAWINGS AND SPECIFICATIONS FOR PANEL INFORMATION.
18. MISCELLANEOUS POWER COMPANY SWITCH REFER TO PRODUCTION LIGHTING DRAWINGS AND SPECIFICATIONS.
19. REFER TO PANEL SCHEDULE FOR ADDITIONAL CIRCUIT BREAKER AND PANEL INFORMATION.

1. SERVICE ENTRANCE EQUIPMENT SHALL BE IN ACCORDANCE WITH THE SERVING ELECTRIC UTILITY COMPANIES REQUIREMENTS (AS APPLICABLE).

2. ALL CONDUCTORS SHALL BE COPPER.

3. DESIGN SHOWN IS BASED ON EATON PRODUCTS, SCHNEIDER ELECTRICAL IS APPROVED EQUAL.

4. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR SUPPLYING ALL SWITCHGEAR SIZED TO FIT IN AVAILABLE ELECTRIC ROOM SPACE(S), FLUSH MOUNTED IN WALL(S) WHERE SHOWN, AND EQUIPMENT LAYOUTS TO CLEAR ALL BUILDING STRUCTURAL FOOTINGS. REFER TO THE ARCHITECTURAL PLANS FOR DIMENSIONAL INFORMATION AND STRUCTURAL PLANS FOR ADDITIONAL INFORMATION NOT SHOWN ON THE ELECTRICAL PLANS. CONTRACTOR SHALL SUBMIT A 1/4" SCALE DRAWING OF ALL SWITCHGEAR, TERMINATION CABINET(S), ETC., ON FLOOR PLAN OF EACH ELECTRIC ROOM WITH SUBMITTAL.

5. VERIFY ALL FEEDER, AND BRANCH CIRCUIT CONDUCTOR SIZES AND PROVIDE PROPERLY SIZED LUGS FOR ALL BREAKERS AS REQUIRED FOR SPECIFIED CONDUCTORS.

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Revision

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Reviewed By:

X/E102
AD10

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COPPER FEEDER SCHEDULE

FEEDER NO.	RACEWAY QUANTITY/SIZE	CONDUCTORS
CO12	(1) 2"C	CONDUIT ONLY WITH PULL ROPE.
ECO12	(1) 2"C	EXISTING CONDUIT ONLY WITH PULL ROPE.
CO22	(1) 2"C	CONDUIT ONLY WITH PULL ROPE.
CO13	(1) 3"C	CONDUIT ONLY WITH PULL ROPE.
CO23	(2) 3"C	CONDUIT ONLY WITH PULL ROPE.
CO33	(3) 3"C	CONDUIT ONLY WITH PULL ROPE.
CO14	(1) 4"C	CONDUIT ONLY WITH PULL ROPE.
CO24	(2) 4"C	CONDUIT ONLY WITH PULL ROPE.
CO34	(3) 4"C	CONDUIT ONLY WITH PULL ROPE.
CO44	(4) 4"C	CONDUIT ONLY WITH PULL ROPE.
M1853	(1) 4"C	(3) #1 AWG CU, 15KV SHIELDED POWER CABLE, TYPE MV-105 WET, EPR INSULATION, PVC JACKET
M2153	(1) 4"C	(3) #1/0 AWG CU, 15KV SHIELDED POWER CABLE, TYPE MV-105 WET, EPR INSULATION, PVC JACKET
M5503	(2) 4"C	(3) #3/0 AWG CU, 15KV SHIELDED POWER CABLE, TYPE MV-105 WET, EPR INSULATION, PVC JACKET, EACH
M6303	(2) 4"C	(3) #4/0 AWG CU, 15KV SHIELDED POWER CABLE, TYPE MV-105 WET, EPR INSULATION, PVC JACKET, EACH
253	(1) 3/4"C	(3) #12 THWN & (1) #12 GND.
254	(1) 3/4"C	(4) #12 THWN & (1) #12 GND.
353	(1) 3/4"C	(3) #10 THWN & (1) #10 GND.
354	(1) 3/4"C	(4) #10 THWN & (1) #10 GND.
354G	(1) 3/4"C	(4) #10 THWN & (1) #8 GND.
503	(1) 3/4"C	(3) #8 THWN & (1) #10 GND.
504	(1) 1"C	(4) #8 THWN & (1) #10 GND.
653	(1) 1"C	(3) #6 THWN & (1) #10 GND.
654	(1) 1"C	(4) #6 THWN & (1) #10 GND.
853	(1) 1-1/4"C	(3) #4 THWN & (1) #8 GND.
854	(1) 1-1/4"C	(4) #4 THWN & (1) #8 GND.
1153	(1) 1-1/2"C	(3) #2 THWN & (1) #6 GND.
1154	(1) 1-1/2"C	(4) #2 THWN & (1) #6 GND.
1154IG	(1) 1-1/2"C	(4) #2 THWN, (1) #6 GND. & (1) #3/0 ISO. GND
1303	(1) 1-1/2"C	(3) #1 THWN & (1) #6 GND.
1304	(1) 1-1/2"C	(4) #1 THWN & (1) #6 GND.
1304IG	(1) 2"C	(4) #1 THWN, (1) #6 GND. & (1) 3/0 ISO. GND
1503	(1) 2"C	(3) #1/0 THWN & (1) #6 GND.
1504	(1) 2"C	(4) #1/0 THWN & (1) #6 GND.
1504IG	(1) 2"C	(4) #1/0 THWN, (1) #6 GND. & (1) #3/0 ISO. GND.
1753	(1) 2"C	(3) #2/0 THWN & (1) #6 GND.
1754	(1) 2"C	(4) #2/0 THWN & (1) #6 GND.
2003	(1) 2"C	(3) #3/0 THWN & (1) #6 GND.
2004	(1) 2"C	(4) #3/0 THWN & (1) #6 GND.
2303	(1) 2-1/2"C	(3) #4/0 THWN & (1) #4 GND.
2304IG	(1) 2-1/2"C	(4) #4/0 THWN, (1) #4 GND & (1) #4 GND.
2305	(1) 2-1/2"C	(4) #4/0 THWN, (1) #4 GND. & (1) #4 ISO. GND
2553	(1) 3"C	(3) #250 KCMIL THWN & (1) #4 GND.
2554	(1) 3"C	(4) #250 KCMIL THWN & (1) #4 GND.

COPPER FEEDER SCHEDULE

FEEDER NO.	RACEWAY QUANTITY/SIZE	CONDUCTORS
2853	(1) 3"C	(3) #300 KCMIL THWN & (1) #4 GND.
2854	(1) 3"C	(4) #300 KCMIL THWN & (1) #4 GND.
3103	(1) 3"C	(3) #350 KCMIL THWN & (1) #4 GND.
3104	(1) 3"C	(4) #350 KCMIL THWN & (1) #4 GND.
3353	(1) 3"C	(3) #400 KCMIL THWN & (1) #4 GND.
3354	(1) 3"C	(4) #400 KCMIL THWN & (1) #4 GND.
3803	(1) 4"C	(3) #500 KCMIL THWN & (1) #3 GND.
3804	(1) 4"C	(4) #500 KCMIL THWN & (1) #3 GND.
3804G	(1) 4"C	(4) #500 KCMIL THWN & (1) #1/0 GND.
4203	(1) 4"C	(3) #600 KCMIL THWN & (1) #2 GND.
4204	(1) 4"C	(4) #600 KCMIL THWN & (1) #2 GND.
4603	(2) 2"C	(3) #4/0 KCMIL THWN & (1) #2 GND. EACH
4604	(2) 2-1/2"C	(4) #4/0 KCMIL THWN & (1) #2 GND. EACH
5103	(2) 3"C	(3) #250 KCMIL THWN & (1) #1 GND. EACH
5104	(2) 3"C	(4) #250 KCMIL THWN & (1) #1 GND. EACH
5104G	(2) 3"C	(4) #250 KCMIL THWN & (1) #1/0 GND. EACH
6203	(2) 4"C	(3) #350 KCMIL THWN & (1) #1 GND. EACH
6204	(2) 4"C	(4) #350 KCMIL THWN & (1) #1 GND. EACH
7603	(2) 4"C	(3) #500 KCMIL THWN & (1) #1/0 GND. EACH
7604	(2) 4"C	(4) #500 KCMIL THWN & (1) #1/0 GND. EACH
7604G	(2) 4"C	(4) #500 KCMIL THWN & (1) #2/0 GND. EACH
8553	(3) 2-1/2"C	(3) #300 KCMIL THWN & (1) #1/0 GND. EACH
8554	(3) 2-1/2"C	(4) #300 KCMIL THWN & (1) #1/0 GND. EACH
10253	(3) 4"C	(3) #400 KCMIL THWN & (1) #2/0 GND. EACH
10254	(3) 4"C	(4) #400 KCMIL THWN & (1) #2/0 GND. EACH
11403	(3) 4"C	(3) #500 KCMIL THWN & (1) #3/0 GND. EACH
11404	(3) 4"C	(4) #500 KCMIL THWN & (1) #3/0 GND. EACH
12404	(4) 3"C	(4) #350 KCMIL THWN & (1) #3/0 GND. EACH
15203	(4) 4"C	(3) #500 KCMIL THWN & (1) #3/0 GND. EACH
15204	(4) 4"C	(4) #500 KCMIL THWN & (1) #3/0 GND. EACH
16753	(5) 4"C	(3) #400 KCMIL THWN & (1) #4/0 GND. EACH
16754	(5) 4"C	(4) #400 KCMIL THWN & (1) #4/0 GND. EACH
19003	(5) 4"C	(3) #500 KCMIL THWN & (1) #250 KCMIL GND. EACH
19004	(5) 4"C	(4) #500 KCMIL THWN & (1) #250 KCMIL GND. EACH
21004	(5) 4"C	(4) #600 KCMIL THWN & (1) #350 KCMIL GND. EACH
24803	(8) 4"C	(3) #350 KCMIL THWN & (1) #250 KCMIL GND. EACH
24804	(8) 4"C	(4) #350 KCMIL THWN & (1) #250 KCMIL GND. EACH
33604	(8) 4"C	(4) #600 KCMIL THWN & (1) #400 KCMIL GND. EACH
42004	(10) 4"C	(4) #600 KCMIL THWN & (1) #500 KCMIL GND. EACH
EXIST (E)		EXISTING CONDUIT OR FEEDER TO REMAIN
M2154	(1) 4"C	(3) #1/0 AWG CU, 15KV 133% EPR CU - OKONITE OKOGUARD OKOSEAL, WITH GREEN (1)#10G CU THWN-2. CONDUCTORS TO MATCH CONDUCTORS PROVIDED FOR POOL COMPLEX

TRANSFORMER SCHEDULE

MARK	DESCRIPTION	VOLTAGE PRIMARY	VOLTAGE SECONDARY	KVA RATING	MAX. DIMENSIONS WIDTH	DEPTH	HEIGHT	MAX. WEIGHT (LBS)	MNTG. DETAIL	ENCLOSURE	LOCATION	NOTE
T7	LIQUID FILLED PAD MOUNTED TRANSFORMER	12KV, 3Ø, 3W	277/480V, 3Ø, 4W	3000	84"	100"	82"	17,000	2/-	NEMA 3R	ELECTRIC YARD	
T8	LIQUID FILLED PAD MOUNTED TRANSFORMER	12KV, 3Ø, 3W	277/480V, 3Ø, 4W	500	74"	63"	75"	6,000	2/-	NEMA 3R	ELECTRIC YARD	
TL1	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	112.5	32"	24"	47"	900	4/E206	NEMA 3R	BUILDING L ROOF	
TL2	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	45	32"	24"	43"	1500	4/E206	NEMA 3R	BUILDING L ROOF	
TLAV	K-13 RATED, DUAL ELECTROSTATIC SHIELD ISOLATED TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	45	32"	24"	43"	1500	4/E206	NEMA 3R	BUILDING L ROOF	
TLRP	K-13 RATED, DUAL ELECTROSTATIC SHIELD ISOLATED TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	75	32"	24"	43"	1500	4/E206	NEMA 3R	BUILDING L ROOF	
TM1	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	225	41"	33"	58"	2000	4/E206	NEMA 3R	BUILDING M ROOF	
TM2	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	15	22"	20"	32"	400	4/E206	NEMA 3R	BUILDING M ROOF	
TM3	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	30	26"	21"	38"	500	4/E206	NEMA 3R	BUILDING M ROOF	
TMAV1	K-13 RATED, DUAL ELECTROSTATIC SHIELD TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	45	41"	33"	58"	2000	4/E206	NEMA 3R	BUILDING M ROOF	
TMRP	K-13 RATED, DUAL ELECTROSTATIC SHIELD TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	225	41"	33"	58"	2000	4/E206	NEMA 3R	BUILDING M ROOF	
TSL	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	45	32"	24"	47"	1200	2/E206	NEMA 3R	ELECTRIC YARD	
TPF	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	45	32"	24"	47"	1200	2/E206	NEMA 3R	ELECTRIC YARD	
TQ1	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	75	32"	24"	47"	1200	4/E206	NEMA 3R	BUILDINQ Q ROOF	
TQ2	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	15	22"	20"	34"	450	4/E206	NEMA 3R	BUILDINQ Q ROOF	
TQ3	DRY TYPE DISTRIBUTION TRANSFORMER	480V, 3Ø, 3W	120/208V, 3Ø, 4W	225	41"	33"	58"	2000	4/E206	NEMA 3R	BUILDINQ Q ROOF	

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ELECTRICAL DISTRIBUTION PULLBOX SCHEDULE

BOX NUMBER	MINIMUM DIMENSIONS LENGTH	WIDTH	DEPTH	COVER TYPE & IDENTIFICATION	COVER RATING
EPB-04	6'-0"	4'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT ELECTRICAL	FULL VEHICULAR TRAFFIC
EPB-05	5'-0"	3'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT ELECTRICAL	FULL VEHICULAR TRAFFIC
EPB-06	3'-0"	2'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT ELECTRICAL	FULL VEHICULAR TRAFFIC
EPB-07	30"	17"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT ELECTRICAL	FULL VEHICULAR TRAFFIC
EPB-08	6'-0"	4'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT LIGHTING	FULL VEHICULAR TRAFFIC

COMMUNICATION SYSTEMS PULLBOX SCHEDULE

BOX NUMBER	MINIMUM DIMENSIONS LENGTH	WIDTH	DEPTH	COVER TYPE & IDENTIFICATION	COVER RATING
CPB-01	5'-0"	3'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT COMMUNICATIONS	FULL VEHICULAR TRAFFIC
CPB-02	5'-0"	3'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT COMMUNICATIONS	FULL VEHICULAR TRAFFIC
CPB-03	5'-0"	3'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT COMMUNICATIONS	FULL VEHICULAR TRAFFIC
CPB-04	6'-0"	4'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT COMMUNICATIONS	FULL VEHICULAR TRAFFIC
CPB-05	3'-0"	2'-0"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT COMMUNICATIONS	FULL VEHICULAR TRAFFIC
CPB-06	30"	17"	AS REQUIRED	ADJUSTABLE SLIP RESISTANT FIRE ALARM	FULL VEHICULAR TRAFFIC
CPB-(E)	EXISTING PULL BOX TO REMAIN				

PULLBOX SCHEDULE NOTES

1. TRAFFIC RATED PULLBOXES AND COVERS SHALL BE PROVIDED TO MEET THE HS20-44 LOADING RATED AS DEFINED BY AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (AASHTO).
2. PULLBOX SIZES AND COVER DESCRIPTIONS ARE BASED ON UTILITY VAULT PUBLISHED SPECIFICATIONS.
3. DUCT BANK DEPTH REQUIREMENTS AND FINISH GRADES MAY REQUIRE THE USE OF EXTENSION RINGS ON PULLBOXES. IT IS THE INTENT OF THE OWNER THAT THE USE OF EXTENSION RINGS IS KEPT TO A MINIMUM AND INSTALLED ONLY WHERE GOOD CONSTRUCTION PRACTICES INDICATE THEIR USE.
4. REFER TO SHEET X/E201 FOR ADDITIONAL INFORMATION AND PULLBOX MOUNTING DETAILS.
5. REFER TO ARCHITECTURAL SITE DEVELOPMENT DETAIL L6-SD/A309 REGARDING CAST-IN-PLACE CONCRETE, PROVIDE CONCRETE MOWSTRIPS / COLLARS AT ALL PULLBOXES, TYPICAL.

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

1. SERVICE ENTRANCE EQUIPMENT SHALL BE IN ACCORDANCE WITH THE SERVING ELECTRIC UTILITY COMPANIES REQUIREMENTS (AS APPLICABLE).
2. ALL CONDUCTORS SHALL BE COPPER.
3. DESIGN SHOWN IS BASED ON EATON PRODUCTS, SCHNEIDER ELECTRICAL IS APPROVED EQUAL.
4. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR SUPPLYING ALL SWITCHGEAR SIZED TO FIT IN AVAILABLE ELECTRIC ROOM SPACE(S), FLUSH MOUNTED IN WALL(S) WHERE SHOWN, AND EQUIPMENT LAYOUTS TO CLEAR ALL BUILDING STRUCTURAL FOOTINGS. REFER TO THE ARCHITECTURAL PLANS FOR DIMENSIONAL INFORMATION AND STRUCTURAL PLANS FOR ADDITIONAL INFORMATION NOT SHOWN ON THE ELECTRICAL PLANS. CONTRACTOR SHALL SUBMIT A 1/4" SCALE DRAWING OF ALL SWITCHGEAR, TERMINATION CABINET(S), ETC., ON FLOOR PLAN OF EACH ELECTRIC ROOM WITH SUBMITTAL.
5. VERIFY ALL FEEDER, AND BRANCH CIRCUIT CONDUCTOR SIZES AND PROVIDE PROPERLY SIZED LUGS FOR ALL BREAKERS AS REQUIRED FOR SPECIFIED CONDUCTORS.

General Notes

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REGISTERED PROFESSIONAL ENGINEER WILLIAM A. THOMA ELECTRICAL STATE OF CALIFORNIA

EXPIRES: 06/30/25

Consultant THOMA #22-8060

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Sanger Unified School District
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Project

TYPICAL INFORMATION

SINGLE LINE DIAGRAM SCHEDULES
Drawing

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LICENSED ARCHITECT REGINEL K. FENNOY Jr. No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

Designed By:
Drawn By:
Checked By:
Reviewed By:

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Scale: As indicated
Project Number: 2171
Date: 08/27/24

X/E104
AD10

WARNING

Arc Flash And Shock Hazard Appropriate PPE Required

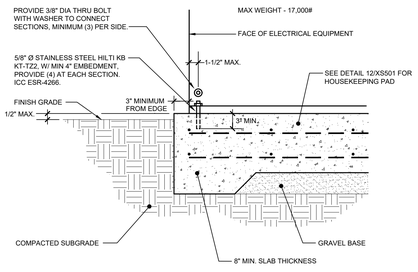
Do not operate controls or open covers without appropriate personal protection equipment.
Failure to comply may result in injury or death!

Refer to NFPA 70E for minimum PPE requirements

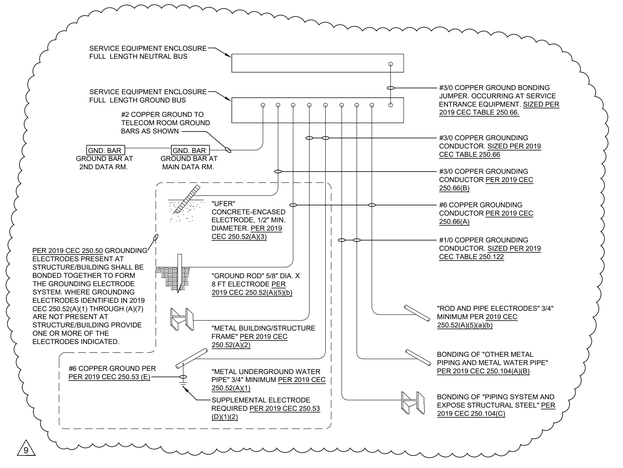
- ARC-FLASH HAZARD WARNING LABEL SHALL BE PROVIDED FOR ALL NEWLY INSTALLED ELECTRICAL EQUIPMENT, SUCH AS SWITCHBOARDS, SWITCHGEAR, ENCLOSED PANELBOARDS, INDUSTRIAL CONTROL PANELS, METER SOCKET ENCLOSURES, AND MOTOR CONTROL CENTERS, THAT IS IN OTHER THAN DWELLING UNITS IN ACCORDANCE WITH CEC 110.16.
- AF LABEL SHALL FOLLOW HAZARD LABEL CONVENTION PER ANSI Z535/NFPA 70E
- PROVIDE DECAL WARNING LABEL WITH BLACK TEXT ON ORANGE BACKGROUND

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3 ARC FLASH SIGNAGE DETAIL
SCALE: NOT TO SCALE



2 ELECTRICAL EQUIPMENT MOUNTING DETAIL
SCALE: NOT TO SCALE



9

1 GROUND / BOND DETAIL
SCALE: NOT TO SCALE

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	CATALOG NO.	VOLTAGE	MAX. VA.	LAMPING	MOUNTING	DESCRIPTION
A	LITHONIA	2VTL2-40L - ADPT-MVOLT-LP835	277	41	LED	RECESSED (8 X/E202)	2x2 LED VOLUMETRIC FIXTURE
A1	LITHONIA	2VTL4-48L - ADPT-MVOLT-LP835	277	47	LED	RECESSED (8 X/E202)	2x4 LED VOLUMETRIC FIXTURE
A2	LITHONIA	2TL4-48L-FW-A19	277	40	LED	RECESSED (8 X/E202)	2x4 LED FIXTURE WITH FLAT WHITE LENSE
A3	LITHONIA	EPANL-2X4-4800LM-80CRI-35K-MIN1-MVOLT-	277	35	LED	RECESSED (8 X/E202)	2x4 LED FLAT PANEL NSF RATED
A4	ARMSTRONG JLC TECH	TBFL-MW-22-UNV	277	10	LED	RECESSED (8 X/E202)	24" LED FIXTURE
A5	LITHONIA	2TL2-40L-FW-A19	277	35	LED	RECESSED (8 X/E202)	2x2 LED FIXTURE WITH FLAT WHITE LENSE
A6	LITHONIA	EPANL-2X2 3400LM-80CRI-35K-MIN1-MVOLT	277	30	LED	RECESSED (8 X/E202)	2x2 LED FLAT PANEL NSF RATED
B	KENALL	MLRS8-48-R-CC-MVOLT	MVOLT	45	LED	SURFACE (4 X/E202)	4' SURFACE MOUNTED LED FIXTURE W/ HIGH IMPACT LENSE
B1 B1-4000K	BEGHELLI LIGHTING	BS100LED-4-VLO-WT35	277	30	LED	CHAIN (2 X/E204)	4' CHAIN MOUNTED LED FIXTURE W/HIGH IMPACT LENSE. PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
B2	RAB LIGHTING	SHARK 8 100NM/D10	277	90	LED	CHAIN (2 X/E204)	8' CHAIN MOUNTED LED FIXTURE W/HIGH IMPACT LENSE
C	NEO-RAY	S125DS-LO35-0048-1C-U-ED-1-C	277	26	LED	SURFACE (4 X/E202)	4' LONG SURFACE MOUNTED LED FIXTURE WITH FLUSH SATIN LENSE
C1	TECH LIGHTING	700FMMGN-13	277	10	LED	SURFACE OR WALL (4 X/E202) (7 X/E202)	13" ROUND SURFACE MOUNTED LED UTILITY FIXTURE
D	PEERLESS BRUNO SOFTSHINE	BRM9L-8-90-35K-ID2000LMF-10/90-C099	277	88	LED	PENDANT (5 X/E203)	8' LONG DIRECT/ INDIRECT PENDANT MOUNTED LED FIXTURE W/SPECULAR REFLECTOR AND SOFT SHINE LENSE, 2000LM PER FT
D1	PEERLESS BRUNO SOFTSHINE	BRM9L-4-90-35K-ID2000LMF-10/90-C099	277	44	LED	PENDANT (5 X/E203)	4' LONG DIRECT/ INDIRECT PENDANT MOUNTED LED FIXTURE W/SPECULAR REFLECTOR AND SOFT SHINE LENSE, 2000LM PER FT
D2	FOCAL POINT	FSM4AL-FL-375LF-35K-UNV-LD1-WH4'	277	20	LED	RECESSED (8 X/E202)	4' LONG RECESSED LED W/WALL WASH DISTRIBUTION
D3	CORONET	LS3POL-LED-LENGTH-35-LTG3-UNV-CC-SM	277	10/W PER L.F.	LED	WALL (7 X/E202)	WALL MOUNTED LED LINEAR FIXTURE, SEE ARCHITECTURAL ELEVATIONS FOR FIXTURE LENGTHS, MOUNT ON WALL PER ARCHITECTURAL PLANS.
D5 D5-4000K	MARK LIGHTING	SL4L-LLP-4'-35K-1000LMF	277	39	LED	RECESSED GYP BD (9 X/E205)	4' LONG RECESSED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D6 D6-4000K	MARK LIGHTING	SL4L-LLP-6'-35K-1000LMF	277	60	LED	RECESSED GYP BD (9 X/E205)	6' LONG RECESSED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D7 D7-4000K	MARK LIGHTING	SL4L-LLP-8'-35K-1000LMF	277	79	LED	RECESSED GYP BD (9 X/E205)	8' LONG RECESSED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D8 D8-4000K	MARK LIGHTING	SL1L-LOP-5'-35K-1000LMF	277	50	LED	RECESSED GYP BD (9 X/E205)	5' LONG RECESSED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D9 D9-4000K	MARK LIGHTING	SL4L-LLP-7'-35K-1000LMF	277	70	LED	RECESSED GYP BD (9 X/E205)	7' LONG RECESSED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D10 D10-4000K	MARK LIGHTING	SL4L-LLP-3'-35K-1000LMF	277	30	LED	RECESSED GYP BD (9 X/E205)	3' LONG RECESSED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D11 D11-4000K	MARK LIGHTING	S4LS-LLP-6'-35K-1000LMF	277	60	LED	SURFACE (4 X/E202)	6' LONG SURFACE MOUNTED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
D12 D12-4000K	MARK LIGHTING	S4LS-LLP-4'-35K-1000LMF	277	40	LED	SURFACE (4 X/E202)	4' LONG SURFACE MOUNTED LED LINEAR FIXTURE, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
E	aLIGHT LIGHTING	RLY3-HEX-DLH-35K-U-S-O	277	12W/ L.F.	LED	AIRCRAFT CABLE (5 X/E207)	CABLE SUSPENDED CUSTOM LED DIMMABLE FIXTURE, SEE ARCHITECTURAL PLAN FOR LENGTHS / SHAPES AND MOUNTING HEIGHTS
F	GOTHAM	EVO 35/10-6AR-MWD-LSS	277	10	LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT WITH CLEAR TRIM
F1 F1-4000K	GOTHAM	EVO-35/20-6AR-MWD-LSS	277	19	LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT WITH CLEAR TRIM, PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
F2	GOTHAM	EVO-35/35-6AR-ND-LSS	277	25	LED	RECESSED (9 X/E205) (10 X/S104)	6" RECESSED LED DOWNLIGHT WITH NARROW DISTRIBUTION
F3	GOTHAM	EVO6-35/150-6AR-ND-LSS	277	151	LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT WITH NARROW DISTRIBUTION
F4	GOTHAM	EVO4-35/15-4AR-MD-LSS	277	15	LED	RECESSED (5 X/E202)	4" RECESSED LED DOWNLIGHT
F5/ F5-4000K	GOTHAM	EVO6-35/60-6AR-ND-LSS	277	58	LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT WITH NARROW DISTRIBUTION , PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
F6	GOTHAM	EV06FS-35/25-MVOLT-EZ1	277	25	LED	RECESSED (5 X/E202)	6" RECESSED DOWNLIGHT NSF RATED, ARCH TO SELECT FIXTURE LENSE
F7 F7-4000K	GOTHAM	EVO6-35/100-6AR-ND-LSS	277	97	LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT WITH NARROW DISTRIBUTION , PROVIDE FIXTURE WITH 4000K COLOR TEMPERATURE WHERE INDICATED ON DRAWINGS
F8	GOTHAM	EV06-40/40-6AR-MWD-LSS-MVOLT	277	40	LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT
F9	3G LIGHTING	3G-DL45RA-22-S80-40K-UNV	277	22	LED	RECESSED (5 X/E202)	4.5" RECESSED LED DOWNLIGHT WITH BLUE LENS OPTION (P/N WAC1024788)
G1	FOCAL POINT	FSML4-SRXP-1000LF-35K-1C-UNV	277	46	LED	RECESSED (9 X/E205) (10 X/S104)	4' LONG RECESSED 4" WIDE NARROW DIMMABLE LED FIXTURE WITH DIRECT DISTRIBUTION.
G2	FOCAL POINT	FSML8-SRXP-1000LF-35K-1C-UNV	277	92	LED	RECESSED (9 X/E205) (10 X/S104)	8' LONG RECESSED 4" NARROW DIMMABLE LED FIXTURE WITH DIRECT DISTRIBUTION
G3	FOCAL POINT	FSML8-SRXP-1000LF-35K-1C-UNV	277	135	LED	RECESSED (9 X/E205) (10 X/S104)	12' LONG RECESSED 4" NARROW DIMMABLE LED FIXTURE WITH DIRECT DISTRIBUTION
G4	FOCAL POINT	FSML8-SRXP-1000LF-35K-1C-UNV	277	184	LED	RECESSED (9 X/E205) (10 X/S104)	16' LONG RECESSED 4" NARROW DIMMABLE LED FIXTURE WITH DIRECT DISTRIBUTION
H	LITHONIA	IBG-36000LM-SEF-ACL GND-MVOLT-40K -80CRI	277	218	4000K LED	SUSPENDED (9 X/E202)	2x4 PENDANT MOUNTED HI-BAY LED FIXTURE MAIN GYM
H1	LITHONIA	IBG-24000LM-SEF-GND-MVOLT-40K -80CRI	277	144	4000K LED	SURFACE (4 X/E202)	SURFACE MOUNTED HI-BAY LED FIXTURE PRACTICE GYM
H2	LITHONIA	IBG-30000LM-SEF-ACL GND-MVOLT-40K -80CRI	277	182	4000K LED	SURFACE (4 X/E202)	SURFACE MOUNTED HI-BAY LED FIXTURE WRESTLING ROOM
JJ	MAXLITE	JJX2U-CSGTA	277	21	LED	WALL (7 X/E202)	WALL MOUNTED DIMMABLE LED JELLY JAR FIXTURE ABOVE CATWALK
K	JUNO	TL381L-35-80CRI-NFL-FINISH	277	100	LED	SURFACE (4 X/E202)	SURFACE MOUNTED LED TRACK HEAD FIXTURE, PROVIDE SINGLE CIRCUIT TRACK WITH LENGTH AS SHOWN ON DRAWINGS AND 100W DIMMABLE CURRENT LIMITER
P	ETC	ARCP4P-35-B	277	100	LED	PENDANT (2 X/E208)	8" PENDANT MOUNTED FIXTURE BLACK BOX THEATER, REFER TO ARCHITECTURAL PLANS FOR MOUNTING HEIGHT
P1	INDY	LC8-P-40LM-35K-MVOLT-G4-80CRI	277	40	LED	PENDANT (2 X/E208)	8" PENDANT MOUNTED FIXTURE DRAMA ROOM
P2	XLAUSA LIGHTING	HEXO-DIR-LM-PDT-35K-UNV-010V-08000L-DM-3FT	277	75	LED	PENDANT (5 X/E203)	PENDANT MOUNTED LED DIMMABLE FIXTURE, SEE ARCHITECTURAL PLAN FOR LENGTHS / SHAPES AND MOUNTING HEIGHTS
S	LITHONIA LIGHTING	DSX2 LED P2 40K 80CRI T3M MVOLT WITH ROUND STEEL POLE	277	350	(2)175W LED	POLE (1 X/E202) (3 X/E202)	TWIN HEAD LED SITE LIGHTING FIXTURE 30' OVERALL MOUNTING HEIGHT TYPE 3 DISTR, WITH INTEGRAL DIMMING CONTROLS
S1	LITHONIA LIGHTING	DSX0 LED P3 40K T3M MVOLT WITH ROUND STEEL POLE	277	69	(1) 69W LED	POLE (2 X/E202) (3 X/E202)	SINGLE HEAD LED SITE LIGHTING FIXTURE 15' OVERALL MOUNTING HEIGHT TYPE 3 DISTR, WITH INTEGRAL DIMMING CONTROLS
S2	LITHONIA LIGHTING	DSX2 LED P2 40K T2M MVOLT WITH ROUND STEEL POLE	277	175	(1)175W LED	POLE (1 X/E202) (3 X/E202)	SINGLE HEAD LED SITE LIGHTING FIXTURE 30' OVERALL MOUNTING HEIGHT TYPE 2 DISTR, WITH INTEGRAL DIMMING CONTROLS
S3	LITHONIA LIGHTING	DSX2 LED P2 40K 80CRI T3M MVOLT WITH ROUND STEEL POLE	277	138	(2) 69W LED	POLE (2 X/E202) (3 X/E202)	TWIN HEAD LED SITE LIGHTING FIXTURE 15' OVERALL MOUNTING HEIGHT, TYPE 3 DISTR, WITH INTEGRAL DIMMING CONTROLS
S4	LITHONIA LIGHTING	DSXB LED 12C 700 40K	277	39	(1)39W LED	CONCRETE BASE (1 X/E206)	42" HIGH LED BOLLARD FIXTURE, ASYMMETRIC , ORIENTATE DISTRIBUTION TOWARD ADJACENT WALKWAY
S5	LITHONIA LIGHTING	DSX2 LED P2 40K T2M MVOLT WITH ROUND STEEL POLE	277	350	(2)175W LED	POLE (1 X/E202) (3 X/E202)	TWIN HEAD LED SITE LIGHTING FIXTURE 30' OVERALL MOUNTING HEIGHT TYPE 2 DISTR, WITH INTEGRAL DIMMING CONTROLS
S7	GOTHAM	EVO6-40/30-6AR-MWD-LSS	277	30	(1)30W LED	RECESSED (5 X/E202)	6" RECESSED LED DOWNLIGHT WITH CLEAR TRIM
S8	LITHONIA LIGHTING	DSXB LED 16C 700 40K	277	39	(1)39W LED	CONCRETE BASE (1 X/E206)	42" HIGH LED BOLLARD FIXTURE, SYMMETRIC DISTRIBUTION
S9	BEGA LIGHTING	24081-K4	277	20	LED	SURFACE (4 X/E202)	LOW PROFILE SURFACE MOUNTED LED FIXTURE
S10	NLS LIGHTING	VUE-3-TT-192L-1-50K-UNV-TA-BS WITH UAT-3-U-3R	277	1188	LED	POLE (2 X/E202) (3 X/E202)	TWIN HEAD LED SITE LIGHTING FIXTURE 15' OVERALL MOUNTING HEIGHT, TYPE 3 DISTR, WITH INTEGRAL DIMMING CONTROLS
S11	NLS LIGHTING	VUE-3-TT-192L-1-50K-UNV-TA-BS WITH TUAT-3-U-3R	277	1782	LED	POLE (2 X/E202) (3 X/E202)	TRIPLE HEAD LED SITE LIGHTING FIXTURE 15' OVERALL MOUNTING HEIGHT, TYPE 3 DISTR, WITH INTEGRAL DIMMING CONTROLS
S13	GARDCO	104L-32L-NW-G1--3-UNV	277	35	(1)35W LED	WALL (7 X/E202)	LED WALL SCONCE
S35	SPEC GRADE LIGHTING	WGE SERIES	277	12000	- LED	POLE	LED SPORTS LIGHTING FIXTURE 35' OVERALL MOUNTING HEIGHT (9)
SB	HYDREL LIGHTING	HSL13 6INCH LED 35K BLU MVOLT L MIN5-FINISH	277	5	LED	RECESSED IN WALL	RECESSED DIMMABLE BLUE LED STEP LIGHT FINISH TO BE SELECTED BY ARCHITECT
SW	HYDREL LIGHTING	HSL13 6INCH LED 35K AMBLW MVOLT L MIN5-FINISH	277	5	LED	RECESSED IN WALL	RECESSED DIMMABLE STATIC WHITE LED STEP LIGHT FINISH TO BE SELECTED BY ARCHITECT
T	a LIGHTING	ACL5-4'-LH-MOD TO RGBW-U-HE-G-D	277	38	LED	RECESSED (9 X/E205)	4"X 4'L RECESSED LINEAR RGBW FIXTURE W ITH DMX CONTROL, MOUNTING AND FINISH TO BE SELECTED BY ARCH, TUNE FIXTURE AT NIGHT AS DIRECTED BY ARCHITECT
T1	a LIGHTING	ACL5-3'-LH-RGBW-U-HE-G-DO	277	29	LED	RECESSED (9 X/E205)	4" X 3'L RECESSED LINEAR RGBW FIXTURE W ITH DMX CONTROL, MOUNTING AND FINISH TO BE SELECTED BY ARCH, TUNE FIXTURE AT NIGHT AS DIRECTED BY ARCHITECT
T2	IGUZZINI	360 LIGHT BLADE TRICK FIXTURE	277	10	LED	SURFACE (4 X/E202)	DECORATIVE LED FIXTURE, AIM AT NIGHT AS DIRECTED BY ARCHITECT
UC	KELVIX	UC40-3500K	120/277	12	LED	UNDER CABINET (7 X/E206)	40" LONG UNDER CABINET LED FIXTURE
V1	LITHONIA	XVML-L48-5000LM	MVOLT	49	LED	SURFACE (4 X/E202)	48" VAPOR TIGHT LED FIXTURE, WITH FULLY GASKETED POLYCARBONATE HOUSING, WET LOCATION LISTED.
W	WAC LIGHTING ENGINEER APPROVED EQUAL	WS-32912-35K-WHT -120/277	277	16	16W LED	WALL (7 X/E202)	12" X 6" W X 3" DEEP LED WALL SCONCE, PROVIDE WITH CUSTOM 3500K COLOR TEMPERATURE
W1	WAC LIGHTING ENGINEER APPROVED EQUAL	WS-85618-35K-WHT -120/277	277	16	16W LED	WALL ABOVE MIRROR (7 X/E202)	18"W LED WALL SCONCE, 3500K COLOR TEMPERATURE
WL	LITHONIA ENGINEER APPROVED EQUAL	2WRTL SERIES	277	30	LED	WALL (7 X/E202)	2X4 WET LOCATION RATED LED FIXTURE
WX	AXIS LIGHTING	WBDIWLED-400-1000 -80-35-SO-SC-4-C-UNV-DP-1+N	277	72	LED	WALL (7 X/E202)	4' WALL MOUNTED WET LOCATED RATED LED FIXTURE WITH NATATORIUM FINISH, +12' AFF MOUNTING HEIGHT
X	SURE-LITES	CX6-1-70-R	277	-	(1)3W LED	WALL OR CLG (7 X/E202) (4 X/E202)	SINGLE SIDED LED DIE CAST EXIT SIGN, WITH DIRECTIONAL ARROW WHERE SHOWN. WALL / CEILING MOUNT. REFER TO ARCHITECTURAL PLANS FOR WALL / CEILING MOUNT REQUIREMENTS. SEE LIGHTING FIXTURE SCHEDULE NOTE #17
X1	SURE-LITES	CX6-2-70-R	277	-	(1)5W LED	CLG (4 X/E202)	TWO SIDED LED DIE CAST EXIT SIGN WITH DIRECTIONAL ARROWS WHERE INDICATED SEE LIGHTING FIXTURE SCHEDULE NOTE #17
X2	SURE-LITES	CHELI-WH-SD-LASER	120/277	-	(2)12W LED	WALL (7 X/E202)	EMERGENCY LIGHTING UNIT WITH INTEGRAL BATTERY PACK SEE LIGHTING FIXTURE SCHEDULE NOTE #17
X3	ISOLITE	2040-70-R-20 -COLOR				WALL (7 X/E202)	SELF POWERED SINGLE SIDED LOW LEVEL EXIT SIGN WITH DIRECTIONAL ARROWS WHERE INDICATED, INSTALL PER CBC REQUIREMENTS. SEE LIGHTING FIXTURE SCHEDULE NOTE #17
DR	CELESTIAL	AQR-R-DF-12"-RLG	120	-	27K 8.8W LED LAMP	WALL (7 X/E202)	DRESSING ROOM MAKEUP LIGHTING FIXTURE WITH LAMPS AT 12" O.C., SEE ARCHITECTURAL ELEVATIONS FOR LOCATION AND QUANTITIES

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

LIGHTING FIXTURE SCHEDULE NOTES

1. ILLUSTRATIONS AND/OR DIMENSIONS ARE APPROXIMATIONS ONLY INTENDED TO REPRESENT BASIC FIXTURE TYPE; DO NOT USE AS EXACT INFORMATION SOURCE. REFER TO MANUFACTURER CUT SHEETS.
2. EXACT LOCATIONS: BEFORE CONSTRUCTION, VERIFY WITH ARCHITECT EXACT LOCATIONS AND MOUNTING HEIGHTS OF ALL LIGHT FIXTURES. SEE ARCHITECTURAL REFLECTED CEILING PLANS AND ELEVATIONS AS APPLICABLE.
3. TRACK LIGHTING: FURNISH TRACK FIXTURES WITH ALL LIVE END FEEDS, END CAPS, MOUNTING HARDWARE, ETC. AS REQUIRED FOR A COMPLETE INSTALLATION. ALL ACCESSORIES SHALL MATCH THE SPECIFIED FIXTURES IN FINISH AND COLOR.
4. FIXTURE BRANCH CIRCUIT THROUGH-WIRING: VERIFY AND COMPLY WITH FIXTURE MANUFACTURER RESTRICTIONS AS DETERMINED BY UL. & NEC.
5. FINAL PLACEMENT AND AIMING OF EXTERIOR ADJUSTABLE FLOOD OR SPOT FIXTURES SHALL BE DETERMINED AFTER DARK WITH OWNER OR ARCHITECT PRESENT. PREARRANGE TIME AND PROVIDE TEMPORARY POWER AS REQUIRED.
6. PROVIDE IN-GRADE UPLIGHTS WITH SURROUNDING SLEEVE AND CRUSHED ROCK FOR PROPER WATER DRAINAGE AS RECOMMENDED BY MANUFACTURER. FIXTURES SHALL BE SEALED (HOT) PER MANUFACTURER'S REQUIREMENTS TO MINIMIZE CONDENSATE IN FIXTURE.
7. VERIFY CEILING TYPES/FINISHES FOR ALL RECESSED FIXTURES PRIOR TO FORWARDING SUBMITTALS.
8. ALL FLAT PRISMATIC LENSES IN FIXTURES SHALL BE MINIMUM .150" THICK.
9. LIGHTING FIXTURES MAY COME DIMMABLE AS A STANDARD PRODUCT, BUT MAY NOT NECESSARILY BE USED IN DIMMING APPLICATIONS. WHEN USED IN DIMMING APPLICATIONS, PROVIDE COMPATIBLE DIMMING EQUIPMENT. REFER TO SITE AND LIGHTING PLANS FOR FIXTURE DIMMING LOCATIONS.
10. ALL LIGHTING FIXTURES PROVIDED SHALL BE FULLY COMPATIBLE WITH THE LIGHTING CONTROL SYSTEM PROVIDED (nLIGHT AIR / nLIGHT / SENSOR SWITCH ENABLED / COMPATIBLE). CONTRACTOR TO VERIFY AND INCLUDE INFORMATION IN SUBMITTALS FOR REVIEW.
11. ALL SITE AND EXTERIOR LIGHTING FIXTURES TO BE PROVIDED AS 4000K COLOR TEMPERATURE RATED FIXTURES.
12. ALL BUILDING INTERIOR LIGHTING FIXTURES TO BE PROVIDED AS 3500K COLOR TEMPERATURE RATED FIXTURES, UNLESS OTHERWISE NOTED.
13. REFER TO FLOOR PLANS FOR FIXTURE LOCATIONS REQUIRING 120V CONNECTIONS.
14. ARCHITECT TO VERIFY / SELECT ALL LIGHTING FIXTURE FINISHES AND COLORS.
15. REFER TO THEATRICAL LIGHTING APPROVED CONSTRUCTION DOCUMENTS FOR FIXTURES TO BE CONTROLLED BY THEATRICAL LIGHTING CONTROL CABINETS, PROVIDE FIXTURES WITH COMPATIBLE CONTROLS (DMX, ETC.) AS REQUIRED.
16. RECESSED FIXTURES INSTALLED IN RATED CEILINGS AND WALLS SHALL BE PROVIDED WITH ADDITIONAL GYPSUM BOARD 'TENTING' REQUIRED TO MAINTAIN CEILING / WALL RATINGS, REFER TO DETAIL 1/X/E208.
17. BLACK BOX THEATRE SHALL HAVE BLACK HOUSING ON ALL EXIT SIGNS.

General Notes

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TYPICAL INFORMATION

LIGHTING FIXTURE SCHEDULE
Drawing

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Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

	Designed By:	Copyright 2021 Darden Architects
Scale: As indicated	Drawn By:	X/E105
Project Number: 2171	Checked By:	AD10
Date: 08/27/24	Reviewed By:	

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(N) PANEL LL2

BUS RATING: 200A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 60 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	LOAD NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
2.57%	173		R	1	RESTROOM RECEPTACLES	20	1	12	540			10	3	20	TELESCOPIC SEATING	2	N		105	0.81%
2.01%	162		R	3	CUSTODIAL GFCI	20	1	10		720						4	N		105	0.81%
2.71%	175		R	5	LOBBY RECEPTACLES	20	1	10			900	10	3			6	N		105	0.81%
2.08%	140		R	7	TICKET BOOTH RECEPTACLES	20	1	12	540			10	3	20	TELESCOPIC SEATING	8	N		102	0.79%
2.08%	140		R	9	TICKET BOOTH RECEPTACLES	20	1	12		540		10	3			10	N		102	0.79%
2.77%	140		R	11	FOY ER RECEPTACLES	20	1	12			720	10	3			12	N		102	0.79%
2.77%	140		R	13	CORRIDOR RECEPTACLES	20	1	12	720			10	3	20	TELESCOPIC SEATING	14	N		102	0.79%
1.62%	82		R	15	CORRIDOR RECEPTACLES	20	1	12		720		10	3			16	N		102	0.79%
				17	SPARE	20	1				0	10	3			18	N		102	0.79%
				19	SPARE	20	1		0			10	3	20	TELESCOPIC SEATING	20	N		102	0.79%
				21	SPARE	20	1			0		10	3			22	N		102	0.79%
				23	SPARE	20	1				0	10	3			24	N		102	0.79%
				25	SPARE	20	1		0			12	1	20	COILING DOOR	26	R		100	0.28%
				27	SPARE	20	1		0				1	20	SPARE	28				
				29	SPARE	20	1			0		12	1	20	COILING DOOR	30	N	5	88	1.21%
0.83%	60		R	31	DRESSING ROOM RECEPTACLES CONTROLLED	20	1	12	500			12	1	20	RESTROOM RECEPTACLES	32	R		45	0.62%
0.83%	60		R	33	DRESSING ROOM RECEPTACLES CONTROLLED	20	1	12		500		12	1	20	DRESSING ROOM RECEPTACLES	34	R		52	0.51%
0.83%	60		R	35	DRESSING ROOM RECEPTACLES CONTROLLED	20	1	12			500	12	1	20	ELEVATOR VIDEO COMPUTER/DRIVING EQUIPMENT	36	N	7		
1.03%	75		R	37	DRESSING ROOM RECEPTACLES CONTROLLED	20	1	12	500			12	1	20	DRESSING ROOM LIGHTING	38	L	1		
1.03%	75		R	39	DRESSING ROOM RECEPTACLES CONTROLLED	20	1	12		500		12	1	20	DRESSING ROOM LIGHTING	40	L	1		
1.03%	75		R	41	DRESSING ROOM RECEPTACLES CONTROLLED	20	1	12			500	10	1	20	LOCBY RECEPTACLES	42	R		175	1.63%
1.72%	125	7	N	43	ELEVATOR EQUIP ROOM LIGHTING/RECEPTACLES	20	1	12	500				1	20	SPARE	44				
1.72%	125	7	N	45	ELEVATOR CONTROLLER	20	1	12		500			1	20	SPARE	46				
1.38%	125	7	N	47	ELEVATOR CAB LIGHTING	20	1	12			400	12	1	20	HVAC CONTACTOR	48	N	4		
2.39%	125	7	N	49	ELEVATOR EQUIP ROOM EXHAUST FAN	20	1	12	696			10	2	30	ELEVATOR CONSTRUCTION RECEPTACLE	50		7		
1.72%	125	7	N	51	ELEVATOR RT LIGHTING/RECEPTACLES	20	1	12		500		10	2		ELEVATOR CONSTRUCTION RECEPTACLE	52		7		
2.53%	125	7	N	53	ELEVATOR RT SUMP PUMP	20	1	10			1176		1	20	SPARE	54				
1.72%	125	7	N	55	ELEVATOR RECALL CONTROL PANEL	20	1	12	500			12	1	20	LOATA PAINEL SHUNT TRIP CIRCUIT BREAKER	56	N			
		7		57	ELEVATOR LIGHT	20	1	12		100		12	1	20	ELEVATOR SHUNT TRIP CIRCUIT BREAKER	58	N	7		
		7		59	ELEVATOR RECEPTACLE	20	1	12			180	12	1	20	METERING EQUIPMENT	60	N			
					CON:	11246	10590	9666												
					25%:	125	125	0												
					SUB:	0	0	0												
					TOT:	11371	10715	9666												
					AMPS	95	89	81												

LOAD (VA) LOAD TYPE LEGEND

9900	R	RECEPTACLE
1000	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
16322	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL LL3

BUS RATING: 200A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 60 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	LOAD NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
1.61%	130		R	1	DRAMA ROOM RECEPTACLES	20	1	10	540			10	1	20	DRAMA OFFICE RECEPTACLES	2	R		145	2.25%
1.93%	130		R	3	DRAMA ROOM RECEPTACLES	20	1	12		540		10	1	20	DRAMA OFFICE RECEPTACLES CONTROLLED	4	R		145	1.80%
1.93%	130		R	5	DRAMA ROOM RECEPTACLES	20	1	12			720	10	1	20	MUSIC OFFICE RECEPTACLES	6	R		155	1.92%
1.29%	130		R	7	DRAMA ROOM GFCI	20	1	12	360			10	1	20	MUSIC OFFICE RECEPTACLES CONTROLLED	8	R		155	1.92%
1.79%	130		R	9	DATA RACK	20	1	12		540		10	1	20	SHEET MUSIC RECEPTACLES	10	R		148	2.20%
1.79%	130		R	11	DATA RACK	20	1	12			500	12	1	20	AV RECEPTACLES	12	R		145	1.99%
2.07%	120		R	13	DRAMA ROOM SPEAKER	20	1	10	1000			12	1	20	COLOR GUARD STORAGE RECEPTACLES	14	R		177	2.74%
2.07%	120		R	15	DRAMA ROOM SPEAKER	20	1	10		1000		10	1	20	BAND STORAGE RECEPTACLES	16	R		175	2.71%
2.79%	180		R	17	DRAMA STORAGE RECEPTACLES	20	1	10			900	12	1	20	CORRIDOR RECEPTACLES	18	R		180	2.67%
1.56%	132		N	19	DRY ER	50	2	6	3000			10	1	20	CONTROL ROOM RECEPTACLES	20	R		167	2.07%
1.56%	132		N	21			2	6		3000		10	1	20	SHEET MUSIC STORAGE RECEPTACLES	22	R		180	2.79%
1.53%	130		N	23	DRY ER	50	2	6			3000	10	1	20	MUSIC OFFICE RECEPTACLES	24	R		200	1.86%
1.53%	130		N	25			2	6	3000			10	1	20	MUSIC OFFICE RECEPTACLES CONTROLLED	26	R		200	1.86%
1.82%	132		N	27	WASHER	20	1	12		500		12	1	20	AUTOMATIC DOOR	28	N		127	1.75%
1.82%	132		N	29	DRY ER	20	1	12			500	12	1	20	AUTOMATIC DOOR	30	N		164	2.26%
1.86%	135		N	31	WASHER	20	1	12	500			12	1	20	AUTOMATIC DOOR	32	N		58	0.80%
1.86%	135		N	33	DRY ER	20	1	12		500		12	1	20	AUTOMATIC DOOR	34	N		63	0.87%
1.92%	206		R	35	2ND FLOOR MECHANICAL RECEPTACLES	20	1	10			540	12	1	20	MOTORIZED SCREEN	36	N		45	0.62%
2.70%	145		R	37	2ND FLOOR CATWALK RECEPTACLES	20	1	10	1080			12	1	20	SPARE	38				
0.70%	75		R	39	2ND FLOOR VESTIBULE RECEPTACLES	20	1	10		540		12	1	20	CER-1	40	N		100	0.28%
1.74%	112		R	41	2ND FLOOR CATWALK RECEPTACLES	20	1	10			900	10	1	20	2ND FLOOR CONTROL ROOM RECEPTACLES	42	R		140	2.17%
1.65%	120		R	43	DRAMA ROOM PLD IOC	20	1	12	500			1		20	SPARE	44				
2.15%	125		R	45	DRAMA BOOM	20	1	10		1000		10	2	30	PROJECTOR	46	N		70	1.04%
0.11%	80		N	47	BCELTS-1	20	3	12			1500	10	2			48	N		70	1.04%
0.11%	80		N	49	BCELTS-1	20	3	12	100			12	1	20	PLD GNC DEVICE	50	R		120	1.65%
0.11%	80		N	51	BCELTS-1	20	3	12		100		12	1	20	HVAC CONTACTORS	52	N	4		
			N	53	HVAC CONTACTORS	20	1	12			100	12	1	20	CER-1	54	N		100	1.38%
				55	SPARE	20	1		0			1	1	20	SPARE	56				
	28		N	57	MECHSME PANEL	28	3		100			1	1	20	DRAMA ROOM	58	L	1	7	
0.39%	26		R	59	ELECTRIC ROOM	20	1	12			540	12	1	20	FIRE ALARM CONTROL CIRCUIT	60	N	4		
					CON:	15040	13640	13920												
					25%:	0	25	0												
					SUB:	0	0	0												
					TOT:	15040	13665	13920												
					AMPS	125	114	116												

LOAD (VA) LOAD TYPE LEGEND

21700	R	RECEPTACLE
100	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
20800	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL LL4

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ROBE STORAGE ROOM (RM 129O)
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	LOAD NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.89%	65		R	1	DATA RACK	20	1	12	500			12	1	20	CORRIDOR RECEPTACLES	2	R		100	1.49%
0.89%	65		R	3	DATA RACK	20	1	12	540			12	1	20	RESTROOM GFCI	4	R		90	1.78%
1.79%	65		R	5	CHOIR/MUSIC SPEAKER	20	1	12		720		10	1	20	PERCUSSION ROOM RECEPTACLES	6	R		187	2.32%
1.14%	83		N	7	MOTORIZED SCREEN	20	1	12			1000	10	1	20	PERCUSSION ROOM RECEPTACLES	8	R		187	2.32%
1.23%	83		R	9	CHOIR/MUSIC RECEPTACLES	20	1	12	500			12	1	20	BAND MUSIC RECEPTACLE	10	R		144	1.98%
1.14%	83		R	11	CHOIR/MUSIC SPEAKER	20	1	12		540		12	1	20	BAND MUSIC RECEPTACLE	12	R		144	2.14%
2.52%	102		R	13	CHOIR/MUSIC RECEPTACLES	20	1	12			500	12	1	20	BAND MUSIC SPEAKER	14	R		80	1.98%
0.95%	64		R	15	CHOIR/MUSIC RECEPTACLES	20	1	12	900			12	1	20	BAND MUSIC RECEPTACLE	16	R		80	1.19%
1.27%	64		R	17	CHOIR/MUSIC RECEPTACLES	20	1	12		540		12	1	20	MOTORIZED SCREEN	18	N		80	1.10%
1.17%	85		N	19	AUTOMATIC DOOR	20	1	12			720	12	1	20	BAND MUSIC SPEAKER	20	R		88	0.76%
1.02%	74		N	21	AUTOMATIC DOOR	20	1	12	500			10	1	20	BAND MUSIC RECEPTACLES	22	R		88	1.21%
1.73%	126		N	23	AUTOMATIC DOOR	20	1	12		500		12	1	20	DATA RACK	24	R		88	1.21%
0.15%	110	4	N	25	SMOKE FIRE DAMPER	20	1	12	50			12	1	20	DATA RACK	26	R		110	1.51%
0.55%	110		N	27	HAND DRYER	30	2	10		500		12	1	20	BAND MUSIC PROJECTOR	28	R		110	1.51%
0.55%	110		N	29	HAND DRYER		2	10	500			10	2	30	HAND DRYER	28	N		100	0.50%
0.50%	100		N	31	HAND DRYER	30	2	10		500		10	2		HAND DRYER	30	N		100	0.50%
0.50%	100		N	33	HAND DRYER		2	10	500			10	2	30	HAND DRYER	32	N		90	0.45%
				35	SPARE	20	1			500		10	2		HAND DRYER	34	N		90	0.45%
				37	SPARE	20	1				500	1	1	20	SPARE	36				
				39	SPARE	20	1					1	1	20	SPARE	38				
				41	SPARE	20	1					1	1	20	SPARE	40				
												1	1	20	SPARE	42				
					CON:	6610	6340	5980												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	6610	6340	5980												
					AMPS	55	53	50												

PANEL NOTES:

LOAD (VA) LOAD TYPE LEGEND

12380	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
6550	N	CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL LLM1

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 60 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM120)
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	LOAD NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.12%	35	5	M	1	EF-L1	20	1	10	200			8	2	25	ODU-L1	2	M	5	200	2.46%
1.77%	195	5	M	3	EF-L2	20	1	10	1976	528		8	2			4	M	5	200	2.46%
2.59%	285	5	M	5	EF-L3	20	1	10		1976	528	12	1	20	WH-2	6	M		168	1.85%
2.91%	320	5	M	7	EF-L4	20	1	10	528		400	12	1	20	SMOKE FIRE DAMPERS	8	N	4	33	0.09%
1.95%	210		R	9	ROOF RECEPTACLE	20	1	10	100	540		12	1	20	SMOKE FIRE DAMPERS	10	N	4	150	0.41%
2.14%	230		R	11	ROOF RECEPTACLE	20	1	10		100	540	12	1	20	SMOKE FIRE DAMPERS	12	N	4	180	0.50%
1.98%	320		R	13	ROOF RECEPTACLE	20	1	10	360		100	12	1	20	SMOKE FIRE DAMPERS	14	N	4	71	0.29%
			M	15	VVH-1ST FLR	20	1	12	150	225		12	1	20	SMOKE FIRE DAMPERS	16	N	4	112	0.15%
			M	17	VVH-1ST FLR	20	1	12		50	150	12	1	20	MOTORIZED TRAP PRIMER	18	N		135	0.74%
			M	19	VVH-1ST FLR	20	1	12	225		200	12	1	20	EMS PANEL	20	N		200	0.55%
			M	21	VVH-1ST FLR	20	1	12	100	150		12	1	20	SPARE	22				
			M	23	VVH-2ND FLR	20	1	12			75	12	1	20	EMS PANEL	24	N			
0.55%	200		N	25	AHL-1 CONTROLS	20	1	12	100		100		2	30	SPARE	26				
0.55%	200		N	27	AHL-2 CONTROLS	20	1	12	0	100			2		SPARE	28				
		4	N	29	SMOKE FIRE DAMPER	20	1	12	0		50	12	1	20	FIRE SPRINKLER BELL	30	N	4	185	0.51%
0.63%	230		N	31	AHL3 CONTROLS	20	1	12	100		100	SLD	3	100	PANEL LLM2	32				
0.66%	240		N	33	AHL4 CONTROLS	20	1	12	4440	100		SLD	3			34				
0.58%	210	5	N	35	WC-L2 HEATER	20	1	12		4440	100	SLD	3			36				
				37	SPARE	25	2		0		3540		1	20	WC-L1 HEATER	38	N	5	200	
				39	SPARE		2		100	0		12	1	20	SMOKE FIRE DAMPERS	40	N		100	0.28%
0.69%	250		N	41	AHL5 CONTROLS	20	1	12		100	100		1	20	SPARE	42				
				43	SPARE	20	1		0	0	0					44				
				45	SPARE	20	1		0	0	0					46				
				47	SPARE	20	1		0	0	0					48				
				49	SPARE	20	1		0	0	0					50				
				51	SPARE	20	1		0	0	0					52				
				53	SPARE	20	1		0	0	0					54				
				55	SPARE	20	1		0	0	0					56				
				57	SPARE	20	1		0	0	0					58				
				59	SPARE	20	1		0	0	0					60				
					CON:	8379	8309	5983												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	8379	8309	5983												
					AMPS	70	69	50												

LOAD (VA) LOAD TYPE LEGEND

1440	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
6961	M	MECHANICAL
0	K	KITCHEN APPLIANCE
1850	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

DPL - SURFACE MOUNT, ELECTRIC ROOM L120

BUS RATING: 1000A, 277/480V, 3PH, 4W
NEMA 1
AIC RATING: 65k

DIST (FT)	PANEL/LOAD	TRIP	POLES	COND SIZE	CONNECTED VA (AMPS) %VD PHASE A	PHASE B	PHASE C	CALC TYPE
28	PANEL HL1	100	3	SLD	7370 (26.6A) 0.00%	3496.25 (12.6A) 0.00%	2837.5 (10.2A) 0.00%	
33	PANEL HLM1	400	3	SLD	72486 (261.7A) 0.02%	59116 (213.4A) 0.01%	70090 (253.0A) 0.02%	
	SPARE	60	3	SLD	0	0	0	
27	TRANS TL1 / PANEL LL1	175	3	SLD	38881 (140.4A) 0.01%	37940 (137.0A) 0.01%	35146 (126.9A) 0.01%	
60	WC-L1	200	3	SLD	44320 (160.0A) 0.02%	44320 (160.0A) 0.02%	44320 (160.0A) 0.02%	
65	WC-L2	200	3	SLD	44320 (160.0A) 0.02%	44320 (160.0A) 0.02%	44320 (160.0A) 0.02%	
55	PANEL ARP-2	100	3	SLD	2500 (9.0A) 0.00%	2375 (8.6A) 0.00%	2375 (8.6A) 0.00%	
34	TRANS TLWP / PANEL EV1	125	3	SLD	14500 (52.3A) 0.00%	14500 (52.3A) 0.00%	14500 (52.3A) 0.00%	
31	TRANS TLAV / PANEL ELEVATOR	80	3	SLD	10500 (37.9A) 0.00%	8500 (30.7A) 0.00%	8500 (30.7A) 0.00%	
	SURGE PROTECTION DEVICE	100	3	SLD	14404 (52.0A) 0	14404 (52.0A) 0	14404 (52.0A) 0	
		60	3	SLD	0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					0	0	0	
					KVA (AMPS)	249.28 (899.9A)	228.97 (826.6A)	236.49 (853.8A)

NOTE: REFER TO LOAD SUMMARY ON SINGLE LINE DIAGRAM

Total KVA 714.74
Total Amps 860

VD CALCULATION TYPE
CON CONNECTED LOAD
CB 80% OF BREAKER RATING

LL1 SURFACE MOUNT, ELECTRIC ROOM L120 WITH 400AMP MAIN BREAKER

BUS RATING: 400A, 120/208V, 3PH, 4W
NEMA 1
AIC RATING: 65K

DIST (FT)	PANEL/LOAD	TRIP	POLES	COND SIZE	CONNECTED VA (AMPS) %VD PHASE A	PHASE B	PHASE C	CALC TYPE
12	PANEL LL2	150	3	SLD	11371 (94.8A) 0.00%	10715 (89.3A) 0.00%	9666 (80.6A) 0.00%	
14	PANEL LL3	200	3	SLD	15040 (125.3A) 0.01%	13665 (113.9A) 0.01%	13920 (116.0A) 0.01%	
220	PANEL LL4	100	3	SLD	6610 (55.1A) 0.05%	6340 (52.8A) 0.05%	5980 (49.8A) 0.05%	
125	PANEL LDATA	100	3	SLD	3860 (32.2A) 0.02%	4720 (39.3A) 0.02%	4080 (34.0A) 0.02%	
	SURGE PROTECTION	60	3	SLD				
40	L103 HAND DRY BR	30	2	10	500 (4.2A) 0.20%	500 (4.2A) 0.20%		
50	L103 HAND DRY BR	30	2	10		500 (4.2A) 0.25%	500 (4.2A) 0.25%	
150	L116A HAND DRYER	30	2	10	500 (4.2A) 0.75%	500 (4.2A) 0.75%		
150	L116A HAND DRYER	30	2	10	500 (4.2A) 0.75%		500 (4.2A) 0.75%	
170	L105 HAND DRY BR	30	2	10		500 (4.2A) 0.84%	500 (4.2A) 0.84%	
170	L105 HAND DRY BR	30	2	10	500 (4.2A) 0.84%	500 (4.2A) 0.84%		
					KVA (AMPS):	38.88 (324.0A)	37.94 (316.2A)	35.15 (292.9A)

Total KVA 111.97
Total Amps 311

VD CALCULATION TYPE
CON CONNECTED LOAD
CB 80% OF BREAKER RATING

(N) PANEL HL1

BUS RATING: 100A 277/480V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	LOAD NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
3.01%	300		L	1	1ST FLOOR SOUTHEAST	20	1	10	3102			10	1	20	EXTERIOR LIGHTING	2	L	1.2		
2.19%	280		L	3	1ST FLOOR SOUTHWEST	20	1	10	300	2417		10	1	20	EXTERIOR LIGHTING	4	L	1.2		
0.98%	150		L	5	1ST FLOOR WOOD SHOP	20	1	12		300		12	1	20	THEATER	6	L	1		
0.95%	205		L	7	1ST FLOOR NORTH	20	1	12	894		1540	12	1	20	THEATER	8	L	1	5	
				9	SPARE	20	1		500	0	500		1	20	SPARE	10				
				11	SPARE	20	1		0		0		1	20	SPARE	12				
0.97%	170		L	13	2ND FLOOR	20	1	12	1100				1	20	SPARE	14				
			N	15	LIGHTING CONTROL PANEL	20	1	12	0	100			1	20	SPARE	16				
			L	17	SECOND FLOOR THEATER	20	1	12		0	500		1	20	SPARE	18				
				19	SPARE	20	1		0		0		1	20	SPARE	20				
				21	SPARE	20	1			0	0		1	20	SPARE	22				
				23	SPARE	20	1				0		1	20	SPARE	24				
				25	SPARE	20	1		0							26				
				27	SPARE	20	1		0	0						28				
				29	SPARE	20	1			0	0					30				
				31	SPARE	20	1		0						

(N) PANEL TRP-1

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS AND
ISOLATED GROUND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
			L	1	RLD-13	20	1	12	500			12	1	20	RLD-13	2	L			
			L	3	RLD-12	20	1	12	500			12	1	20	RLD-12	4	L			
			L	5	RLD-11	20	1	12		500		12	1	20	RLD-11	6	L			
			L	7	RLD-9	20	1	12		500		12	1	20	RLD-9	8	L			
			L	9	RLD-8	20	1	12			500	12	1	20	RLD-8	10	L			
			L	11	RLD-7	20	1	12			500	12	1	20	RLD-7	12	L			
			L	13	RLD-4	20	1	12	500			12	1	20	RLD-4	14	L			
			L	15	RLD-6	20	1	12	500			12	1	20	RLD-6	16	L			
			L	17	RLD-6	20	1	12			500	12	1	20	RLD-5	18	L			
			L	19	RLD-5	20	1	12	500			12	1	20	RLD-5	20	L			
			L	21	RLD-3	20	1	12		500		12	1	20	RLD-3	22	L			
			L	23	RLD-1	20	1	12			500	12	1	20	RLD-1	24	L			
				25	SPACE				0				1	20	SPARE	26				
				27	SPACE					0			1	20	SPARE	28				
				29	SPACE						0		1	20	SPARE	30				
				31	SPACE				0				1	20	SPARE	32				
				33	SPACE					0			1	20	SPARE	34				
				35	SPACE						0		1	20	SPARE	36				
				37	SPACE				0				1	20	SPARE	38				
				39	SPACE					0			1	20	SPARE	40				
				41	SPACE						0		1	20	SPARE	42				
									0											
					CON:	4000	4000	4000												
					25%:	1000	1000	1000												
					SUB:	0	0	0												
					TOT:	5000	5000	5000												
					AMPS	42	42	42												

LOAD (VA)	LOAD TYPE	LEGEND
0	R	RECEPTACLE
12000	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
0	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL AV-1B

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: A/MP ROOM (RM 126)
WITH EQUIPMENT GND BUS AND
ISOLATED GROUND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.34%	25		R	1	CONTROL ROOM	20	1	12	500			12	1	20	STORAGE	2	R		40	0.59%
0.55%	40		R	3	CONTROL ROOM	20	1	12	500			12	1	20	LIVE ROOM	4	R		30	0.41%
0.83%	60		R	5	CONTROL ROOM	20	1	12		500		12	1	20	LIVE ROOM	6	R		40	0.55%
0.96%	70		R	7	CONTROL ROOM	20	1	12	500			12	1	20	LIVE ROOM	8	R		50	0.69%
1.10%	80		R	9	CONTROL ROOM	20	1	12		500		12	1	20	LIVE ROOM	10	R		60	0.83%
1.24%	90		R	11	CONTROL ROOM	20	1	12			500	12	1	20	LIVE ROOM	12	R		80	1.10%
0.55%	20		N	13	AMP ROOM	20	1	12	1000			12	1	20	LIVE ROOM	14	R		100	1.38%
0.55%	20		N	15	AMP ROOM	20	1	12		1000		12	1	20	SPARE	16				
0.55%	20		N	17	AMP ROOM	20	1	12			1000	12	1	20	SPARE	18				
0.55%	20		N	19	AMP ROOM	20	1	12	1000			12	1	20	SPARE	20				
				21	SPARE	20	1			0		12	1	20	SPARE	22				
				23	SPARE	20	1				0	12	1	20	SPARE	24				
				25	SPARE	20	1		0			12	1	20	SPARE	26				
				27	SPARE	20	1			0		12	1	20	SPARE	28				
				29	SPARE	20	1				0	12	1	20	SPARE	30				
				31	SPARE	20	1		0							32				
				33	SPARE	20	1			0						34				
				35	SPARE	20	1				0					36				
				37	SPARE	20	1		0							38				
				39	SPARE	20	1			0						40				
				41	SPARE	20	1				0					42				
					CON:	4500	3000	3000												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	4500	3000	3000												
					AMPS	38	25	25												

LOAD (VA)	LOAD TYPE	LEGEND
6500	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
4000	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL LDATA

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: 100A SHUNT TRIP MAIN BREAKER
SPACES: 30 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: IDF 107
WITH EQUIPMENT GND BUS AND
ISOLATED GROUND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.25%	18		R	1	DATA ROOM	20	1	12	500				2	50	SPARE	2				
0.44%	22		R	3	DATA ROOM	20	1	12	2500				2		SPARE	4				
0.44%	22		R	5	DATA ROOM	20	1	12		720			2		SPARE	6				
0.20%	20		R	7	DATA ROOM	20	1	12	360	2500		720	10	1	30	DATA ROOM	6	R	16	0.41%
				9	SPARE	20	1		500			1500	12	1	20	DATA ROOM	8	R	20	0.28%
	5		N	11	SECURITY EQUIPMENT	20	1	12			360		1	20	SPARE	10				
				13	SPARE	20	1						3	40	SPARE	12				
				15	SPARE	20	1						3		SPARE	14				
				17	SPACE								3		SPARE	16				
				19	SPACE								2	20	SPARE	18				
				21	SPACE								2		SPARE	20				
				23	SPACE							6	3	60	SURGE PROTECTION DEVICE	22		5		
				25	SPACE							6	3		SURGE PROTECTION DEVICE	24		5		
				27	SPACE							6	3			26		5		
				29	SPACE							10	2	25	ODU-L2	28	M	5		
									1500											
											1500	10	2		ODU-L2	30	M	5		
					CON:	3860	4720	4080												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	3860	4720	4080												
					AMPS	32	39	34												

PANEL NOTES:

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LOAD (VA)	LOAD TYPE	LEGEND
4300	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
3000	M	MECHANICAL
0	K	KITCHEN APPLIANCE
360	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

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(N) PANEL AV-1

BUS RATING: 225A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS AND
ISOLATED GROUND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.69%	80		R	1	THEATER	20	1	10	500			10	1	20	LOBBY	2	R		200	1.72%
0.86%	100		R	3	THEATER	20	1	10	500			10	1	20	LOBBY	4	R		200	1.72%
1.64%	190		R	5	THEATER	20	1	10		500		10	1	20	LOBBY	6	R		200	1.72%
0.69%	50		R	7	THEATER	20	1	12	500			10	1	20	LOBBY	8	R		200	1.72%
0.69%	80		R	9	THEATER	20	1	10		500			1	20	SPARE	10				
1.29%	150		R	11	THEATER	20	1	10			500		1	20	SPARE	12				
				13	SPARE	20	1		0				1	20	SPARE	14				
				15	SPARE	20	1			0			1	20	SPARE	16				
				17	SPARE	20	1				0	6	3	60	SURGE PROTECTION DEVICE	18				
				19	SPARE	20	1		0			6	3			20				
				21	SPARE	20	1			0		6	3			22				
				23	SPARE	20	1				0					24				
				25	SPARE	20	1		0							26				
				27	SPARE	20	1			0						28				
				29	SPARE	20	1				0					30				
				31	SPARE	20	1		0							32				
				33	SPARE	20	1			0						34				
				35	SPARE	20	1				0					36				
0.27%	50			37	PANEL AV-1A	100	3	2	4000			2	3	100	PANEL AV-1B	38			145	0.58%
0.27%	50			39	PANEL AV-1A		3	2	4500	4000		2	3		PANEL AV-1B	40			145	0.58%
0.27%	50			41	PANEL AV-1A		3	2		3000	4000	2	3		PANEL AV-1B	42			145	0.58%
					CON:	10500	8500	8500												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	10500	8500	8500												
					AMPS	88	71	71												

LOAD (VA)	LOAD TYPE	LEGEND
5000	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
0	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL LLM2

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 4X
LOCATION: WOOD SHOP L123
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.79%	40		R	1	WOOD SHOP RECEPTACLES	20	1	12	720			12	1	20	WOOD SHOP RECEPTACLES	2	R		80	1.58%
0.99%	50		R	3	WOOD SHOP RECEPTACLES	20	1	12	720			12	1	20	WOOD SHOP RECEPTACLES	4	R		90	1.78%
0.96%	70		R	5	WOOD SHOP RECEPTACLES	20	1	12			540	12	1	20	WOOD SHOP RECEPTACLES	6	R		120	1.78%
0.83%	60		N	7	COILING DOOR	20	1	12	500			12	1	20	WOOD SHOP CORD REEL	8	R		60	0.83%
1.24%	90		N	9	COILING DOOR	20	1	12		500		12	1	20	WOOD SHOP CORD REEL	10	R		60	0.83%
1.24%	90		N	11	AUTOMATIC DOOR	20	1	12			500	12	1	20	WOOD SHOP CORD REEL	12	R		60	0.83%
0.55%	20		R	13	WOOD SHOP RECEPTACLE - BAND SAW	20	1	12	1000			12	1	20	WOOD SHOP CORD REEL	14	R		60	0.83%
0.83%	30		R	15	WOOD SHOP RECEPTACLE-DRILL PRESS	20	1	12		1000		12	1	20	WOOD SHOP CORD REEL	16	R		60	0.83%
0.20%	80		R	17	WOOD SHOP RECEPTACLE-MITRE SAW	20	1	12			1000	12	1	20	WOOD SHOP CORD REEL	18	R		60	0.83%
				19	SPARE	20	1		0			12	1	20	WOOD SHOP CORD REEL	20	R		60	0.83%
				21	SPARE	20	1			500		12	1	20	WOOD SHOP CORD REEL	22	R		60	0.83%
				23	SPARE	20	1				0				SPACE	24				
				25	SPARE	20	1		0						SPACE	26				
				27	SPARE	20	1			0					SPACE	28				
				29	SPARE	20	1				0				SPACE	30				
				31					0						SPACE	32				
				33						0					SPACE	34				
				35							0				SPACE	36				
				37					0						SPACE	38				
				39						0					SPACE	40				
				41							0				SPACE	42				
									0											
					CON:	4440	4440	3540												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	4440	4440	3540												
					AMPS	37	37	30												

LOAD (VA)	LOAD TYPE	LEGEND
10920	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
1500	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL ARP-2

BUS RATING: 100A 277/480V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
1.24%	200	1	L	1	THEATER PENDANT LIGHTING	20	1	12	0				1	20	SPARE	2				
1.24%	200	1	L	3	THEATER PENDANT LIGHTING	20	1	12		1200		12	1	20	THEATER STEP LIGHTS	4	L	1	200	0.62%
1.70%	300	1	L	5	THEATER PENDANT LIGHTING	20	1	12			1100	12	1	20	THEATER STEP LIGHTS	6	L	1	200	0.72%
1.24%	300	1	L	7	THEATER PENDANT LIGHTING	20	1	12	800	600	700		1	20	SPARE	8				
0.10%	200	1	L	9	THEATER DOWNLIGHTING	20	1	12	0				1	20	SPARE	10				
0.10%	200	1	L	11	THEATER DOWNLIGHTING	20	1	12		100			1	20	SPARE	12				
				13	SPARE	20	1		0	0			1	20	SPARE	14				
				15	SPARE	20	1			0			1	20	SPARE	16				
				17	SPARE	20	1				0		1	20	SPARE	18				
				19	SPARE	20	1		0				1	20	SPARE	20				
				21	SPARE	20	1			0			1	20	SPARE	22				
				23	SPARE	20	1				0		1	20	SPARE	24				
				25	SPACE				0						SPACE	26				
				27	SPACE					0					SPACE	28				
				29	SPACE						0				SPACE	30				
				31	SPACE				0						SPACE	32				
				33	SPACE					0					SPACE	34				
				35	SPACE						0				SPACE	36				
				37	SPACE				0						SPACE	38				
				39	SPACE					0					SPACE	40				
				41	SPACE						0				SPACE	42				
					CON:	2000	1900	1900												
					25%:	500	475	475												
					SUB:	0	0	0												
					TOT:	2500	2375	2375												
					AMPS	9	9	9												

LOAD (VA)	LOAD TYPE	LEGEND
0	R	RECEPTACLE
5800	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
0	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

(N) PANEL AV-1A

BUS RATING: 100A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: CONTROL ROOM (RM L208)
WITH EQUIPMENT GND BUS AND
ISOLATED GROUND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
0.83%	60		R	1	THEATER	20	1	12	500			10	1	20	CONTROL ROOM	2	R		200	1.72%
1.24%	90		R	3	THEATER	20	1	12	500			10	1	20	CONTROL ROOM	4	R		200	1.72%
1.65%	120		R	5	THEATER	20	1	12		500		10	1	20	CONTROL ROOM	6	R		200	1.72%
1.38%	100		R	7	THEATER	20	1	12	500	500		12	1	20	A/V ROOM	8	N		40	1.10%
1.65%	120		R	9	THEATER	20	1	12	1000	500		12	1	20	A/V ROOM	10	N		40	1.10%
2.06%	150		R	11	THEATER	20	1	12		1000	500	12	1	20	A/V ROOM	12	N		40	1.10%
1.55%	180		R	13	THEATER	20	1	10	500		1000	12	1	20	A/V ROOM	14	N		40	1.10%
1.72%	200		R	15	CONTROL ROOM	20	1	10	1000	500		12	1	20	A/V ROOM	16	N		40	1.10%
1.72%	200		R	17	CONTROL ROOM	20	1	10		1000	500	12	1	20	A/V ROOM	18	N		40	1.10%
				19	SPARE	20	1		0							20				
				21	SPARE	20	1		0	0						22				
				23	SPARE	20	1				0					24				
				25	SPARE	20	1		0		0					26				
				27	SPARE	20	1		0	0						28				
				29	SPARE	20	1				0					30				
				31	SPARE	20	1		0		0					32				
				33	SPARE	20	1		0	0						34				
				35	SPARE	20	1				0					36				
				37	SPARE	20	1		0		0					38				
				39	SPARE	20	1		0	0						40				
				41	SPARE	20	1				0					42				
					CON:	4000	4000	4000												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	4000	4000	4000												
					AMPS	33	33	33												

LOAD (VA)	LOAD TYPE	LEGEND
6000	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
6000	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

9

(N) PANEL TLM

BUS RATING: 400A 120/208V, 3PH, 4W
MAIN: MLO MAIN LUG ONLY
SPACES: 42 FULL SIZE BOLT-ON CB SPACES
AIC RATING: 65 KAIC PANEL

SURFACE MOUNT, NEMA 1
LOCATION: ELECTRIC ROOM (RM 120)
WITH EQUIPMENT GND BUS AND
ISOLATED GROUND BUS

CKT %VD	DIST (FT)	NOTES	LOAD TYPE	CKT	DESCRIPTION	TRIP	POLES	COND SIZE	CONNECTED VA PHASE A	PHASE B	PHASE C	COND SIZE	POLES	TRIP	DESCRIPTION	CKT	LOAD TYPE	NOTES	DIST (FT)	CKT %VD
				1	SURGE PROTECTION DEVICE	60	3	6	0				1	20	SPARE	2				
				3			3	6		0			1	20	SPARE	4				
				5			3	6			0		1	20	SPARE	6				
1.51%	110		N	7	FOUNDRY PANEL	20	1	12	500				1	20	SPARE	8				
1.51%	110		N	9	FOUNDRY PANEL	20	1	12		500			1	20	SPARE	10				
1.51%	110		N	11	FOUNDRY PANEL	20	1	12			500		1	20	SPARE	12				
1.51%	110		N	13	FOUNDRY PANEL	20	1	12	500				1	20	SPARE	14				
1.51%	110		N	15	FOUNDRY PANEL	20	1	12		500			1	20	SPARE	16				
1.51%	110		N	17	FOUNDRY PANEL	20	1	12			500					18				
1.51%	110		N	19	FOUNDRY PANEL	20	1	12	500							20				
1.51%	110		N	21	FOUNDRY PANEL	20	1	12		500						22				
				23							500					24				
				25					0							26				
				27						0						28				
				29							0					30				
				31					0			2	3	100	POWER COMPANY SWITCH	32				
				33						0		2	3		POWER COMPANY SWITCH	34				
				35							0	2	3		POWER COMPANY SWITCH	36				
0.36%	53			37	PANEL TRP-1	100	3	2	5000							38				
0.36%	53			39	PANEL TRP-1		3	2		5000						40				
0.36%	53			41	PANEL TRP-1		3	2			5000					42				
					CON:	14500	14500	14500												
					25%:	0	0	0												
					SUB:	0	0	0												
					TOT:	14500	14500	14500												
					AMPS	121	121	121												

LOAD (VA)	LOAD TYPE	LEGEND
0	R	RECEPTACLE
0	L	LIGHTING (125% OF CONNECTED LOAD CEC 215.2)
0	M	MECHANICAL
0	K	KITCHEN APPLIANCE
4000	N	NON-CONTINUOUS MISC.
0	C	CONTINUOUS MISC. (125% OF CONNECTED LOAD CEC 215.2)

DSA File No.:
DSA File

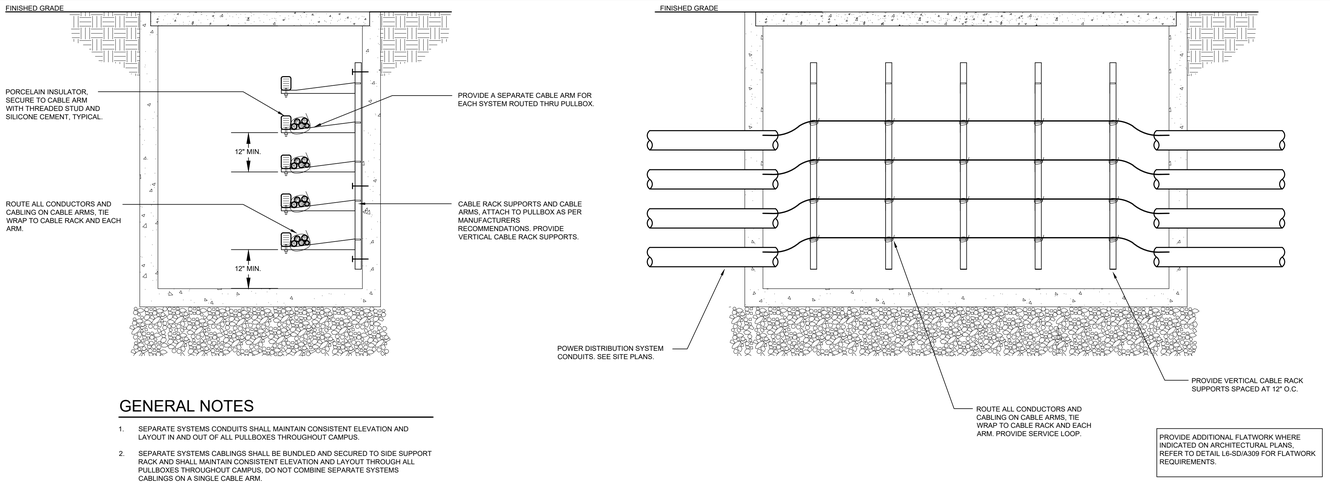
DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

PANEL SCHEDULE NOTES

1. LONG CONTINUOUS LOAD (LCL). ADDITIONAL 25% ADDED AT BOTTOM OF PANEL. FEEDER CALCULATED AT 125% OF TOTAL CONNECTED LOAD.
2. ROUTE BRANCH CIRCUIT THROUGH LIGHTING CONTROLS.
3. "SHUNT TRIP" TYPE

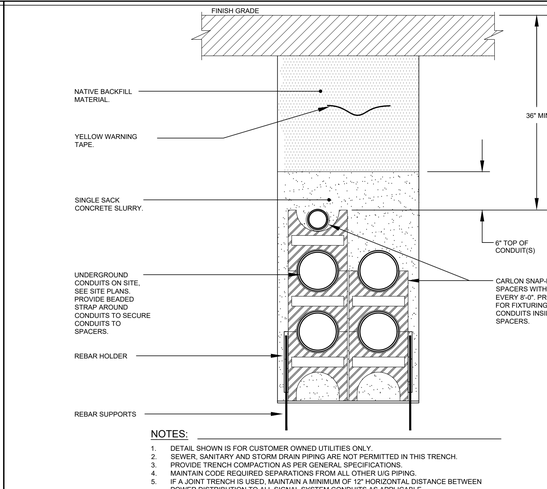


GENERAL NOTES

1. SEPARATE SYSTEMS CONDUITS SHALL MAINTAIN CONSISTENT ELEVATION AND LAYOUT IN AND OUT OF ALL PULLBOXES THROUGHOUT CAMPUS.
2. SEPARATE SYSTEMS CABLINGS SHALL BE BUNDLED AND SECURED TO SIDE SUPPORT RACK AND SHALL MAINTAIN CONSISTENT ELEVATION AND LAYOUT THROUGH ALL PULLBOXES THROUGHOUT CAMPUS, DO NOT COMBINE SEPARATE SYSTEMS CABLINGS ON A SINGLE CABLE ARM.

7 TYPICAL PULLBOX LAYOUT / RACKING

SCALE:

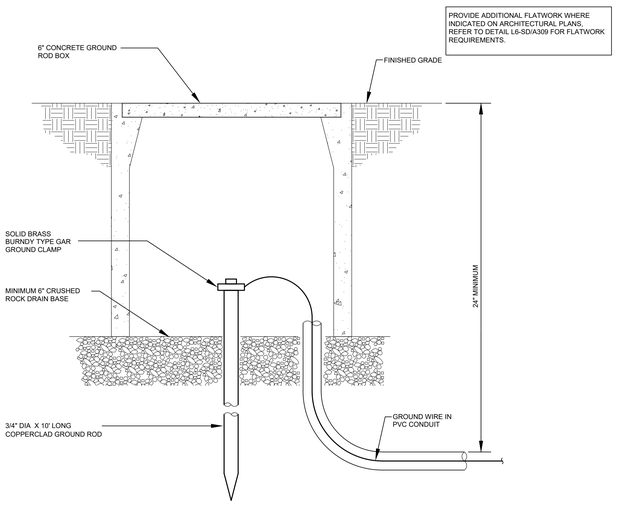


NOTES:

1. DETAIL SHOWN IS FOR CUSTOMER OWNED UTILITIES ONLY.
2. SEWER, SANITARY AND STORM DRAIN PIPING ARE NOT PERMITTED IN THIS TRENCH.
3. PROVIDE TRENCH COMPACTION AS PER GENERAL SPECIFICATIONS.
4. MAINTAIN CODE REQUIRED SEPARATIONS FROM ALL OTHER U/G PIPING.
5. IF A JOINT TRENCH IS USED, MAINTAIN A MINIMUM OF 12" HORIZONTAL DISTANCE BETWEEN POWER DISTRIBUTION TO ALL SIGNAL SYSTEM CONDUITS AS APPLICABLE.

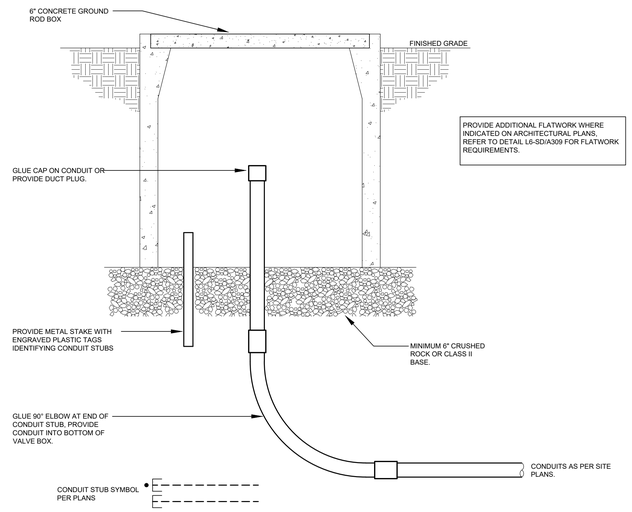
1 CONDUITS IN TRENCH DETAIL

SCALE: NTS



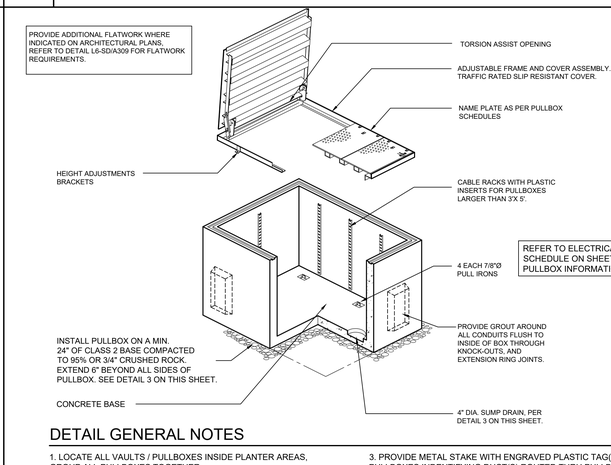
8 GROUND ROD / GROUND WELL

SCALE: NTS



5 CONDUIT STUB AT PULL BOX

SCALE: NTS

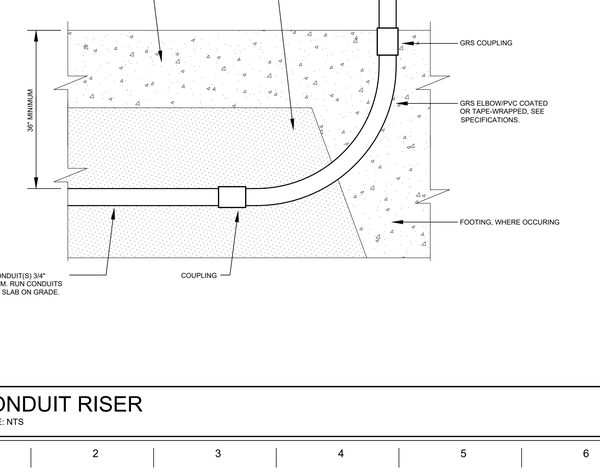


DETAIL GENERAL NOTES

1. LOCATE ALL VAULTS / PULLBOXES INSIDE PLANTER AREAS, GROUP ALL PULLBOXES TOGETHER.
2. DETAIL SHOWN IS FOR PULLBOXES 2' X 3' AND LARGER.
3. SEE DETAILS ON THIS SHEET FOR CABLE RACK SUPPORT REQUIREMENTS.
3. PROVIDE METAL STAKE WITH ENGRAVED PLASTIC TAG(S) IN PULLBOXES INDENTIFYING DUCT(S) ROUTED THRU PULLBOXES.
4. REFER TO ARCHITECTURAL SITE DEVELOPMENT DETAILS REGARDING CAST-IN-PLACE CONCRETE, CONCRETE MOWSTRIPS / COLLARS AT ALL ELECTRICAL PULLBOXES, TYPICAL.

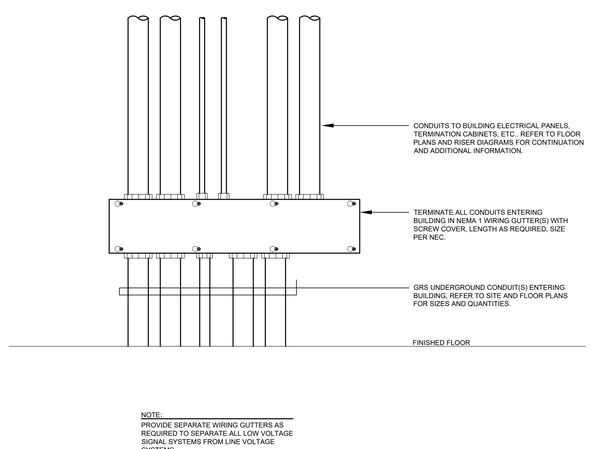
2 CONCRETE PULLBOX MOUNTING

SCALE: NTS



9 CONDUIT RISER

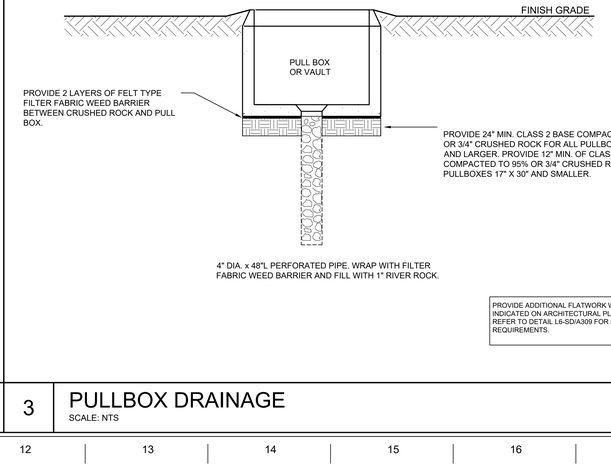
SCALE: NTS



NOTE:
PROVIDE SEPARATE WIRING GUTTERS AS REQUIRED TO SEPARATE ALL LOW VOLTAGE SIGNAL SYSTEMS FROM LINE VOLTAGE SYSTEMS.

6 CONDUIT INSTALLATION INTO BLDG

SCALE: NTS



3 PULLBOX DRAINAGE

SCALE: NTS

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

General Notes

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EXPIRES: 06/30/25
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Project

TYPICAL INFORMATION

ELECTRICAL DETAILS

Drawing

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LICENSED ARCHITECT RICHARD K. FERNOW No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

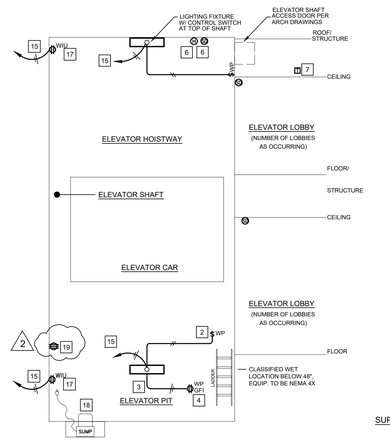
Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

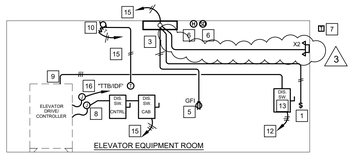
Revision

	Designed By:	Copyright 2021 Darden Architects
Scale: As indicated	Drawn By:	
Project Number: 2171	Checked By:	X/E201
Date: 08/27/24	Reviewed By:	AD10

K:\ENG\2022\22-8060\22-8060_XE201-XE208_ELEC DETAILS.dwg - Roger - Oct 01, 2026 - 7:29am



SHAFT SECTION / ELEVATION DIAGRAM



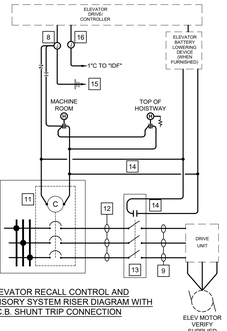
EQUIPMENT ROOM SECTION / ELEVATION DIAGRAM

☐ REFERENCE NOTES

1. ELEVATOR EQUIPMENT ROOM LIGHT SWITCH LOCATED WITHIN 18" OF THE STRIKE SIDE OF THE DOOR. (CEC 620-23B)
2. MOUNT SWITCH 18" MINIMUM TO 36" MAXIMUM ABOVE SILL IN HOIST WAY. (CEC 620-24B)
3. 120V FIXTURES CONNECTED TO LINE SIDE OF ROOM BRANCH CIRCUIT, PRIOR TO GFI RECEPTACLE. REFER TO LIGHTING PLAN AND LUMINAIRE SCHEDULE.
4. WP/GFI RECEPTACLE PER CEC 620-24.
5. GFI RECEPTACLE PER CEC 620-23.
6. FIRE ALARM HEAT / SMOKE DETECTOR.
7. AT PROJECT LOCATIONS THAT REQUIRE A VALVE TO CONTROL THE FIRE SPRINKLER HEAD(S) SERVING THE ELEVATOR MACHINE ROOM OR THE ELEVATOR HOISTWAY, CONNECT THE VALVE TAMPER SWITCH TO A SUPERVISED CIRCUIT OF THE FIRE ALARM CONTROL PANEL.
8. (2) DEDICATED 120 VOLT CONTROL BRANCH CIRCUITS CONNECTED THROUGH DIS. SW. WITH LOCK-OFF DEVICE LOCATED IN EQUIPMENT ROOM. CONNECT (1) CIRCUIT TO ELEVATOR DRIVE UNIT CONTROLLER & SHUNT TRIP DEVICE AND (1) CIRCUIT TO ELEVATOR CAR LIGHT & RECEPTACLE FEED POINT. (CEC 620-22).
9. POWER FEEDER FROM FUSED DISCONNECT SWITCH TO ELEVATOR DRIVE UNIT. REFER TO SINGLE LINE DIAGRAM OR PANEL SCHEDULE FOR CONDUCTOR/CONDUIT REQUIREMENTS.
10. CONNECT TO 120 VOLT ROOM EXHAUST FAN AND LINE VOLTAGE THERMOSTAT. COORDINATE WITH DIVISION 15 REQUIREMENTS.
11. ELEVATOR DRIVE UNIT DISTRIBUTION CIRCUIT BREAKER WITH 120VAC SHUNT-TRIP MODULE.
12. FEEDER FROM SWITCHBOARD OR BRANCH PANEL. REFER TO SINGLE LINE DIAGRAM OR PANEL SCHEDULE FOR CONDUCTOR/CONDUIT REQUIREMENTS.
13. FUSED DISCONNECT SWITCH, HEAVY DUTY, LOCKABLE, IN MACHINE ROOM PER NEC 620-51. MOUNT AT A READILY ACCESSIBLE LOCATION ON THE STRIKE SIDE FOR THE DOOR. REFER TO SINGLE LINE DIAGRAM FOR SIZE/CONDUCTOR/CONDUIT REQUIREMENT.
14. CONTROL WIRING TO BATTERY LOWERING DEVICE, ELEVATOR CONTROLLER, AND/OR SHUNT TRIP BREAKER, COORDINATE WITH ELEVATOR SUPPLIER AND PROVIDE INSTALLATION ACCORDINGLY.
15. DEDICATED 120 VOLT BRANCH CIRCUIT.
16. (1) DEDICATED TELEPHONE LINE AND (1) DEDICATED DATA LINE TO EACH ELEVATOR FROM EQUIPMENT IN LOCAL BLDG IDF ROOM. CONNECT TO ELEVATOR CONTROLLER.
17. TOP OF SHAFT 2-POLE RECEPTACLE WITH WIRE LEASE COVER TO SUPPLY SUMP PUMP IN PIT (WHERE REQUIRED). (620-85)
18. SUMP PUMP/FLOAT SWITCH (WHERE REQUIRED) FURNISHED AND INSTALLED BY OTHERS. DIVISION 26 TO PROVIDE RECEPTACLE AND CONNECT TO 120 VOLT BRANCH CIRCUIT. COORDINATE WITH DIVISION 15 REQUIREMENTS.
19. PROVIDE 208V, 30AMP, SINGLE PHASE 4 WIRE RECEPTACLE FOR ELEVATOR CONSTRUCTION. INSTALLATION, CONTACT ELEVATOR SUPPLIER AND COORDINATE EXACT LOCATION, AND NEMA CONFIGURATION DIRECTLY WITH ELEVATOR SUPPLIER.

ELEV. DETAIL -GENERAL NOTES

- THE INSTALLATION SHALL BE IN ACCORD WITH CEC ARTICLE 620 AND ANSI A17.1. ELEVATOR CODE.
- SEE LIGHTING AND POWER FLOOR PLANS FOR ADDITIONAL REQUIREMENTS.
- PROVIDE WIREGUARD(S) ON ALL LIGHTING FIXTURES IN ELEVATOR MACHINE ROOM(S) AND ELEVATOR PIT(S).
- NO CONDUIT, WIRING, DUCTS OR PIPING FOREIGN TO THE OPERATION OF THE ELEVATOR ARE ALLOWED IN ELEVATOR MACHINE ROOMS.
- ELEVATOR HOIST WAY AND MACHINE ROOM DETAILS ARE NOT PROJECT SPECIFIC.
- CONTRACTOR SHALL VERIFY ALL REQUIREMENTS AND ELEVATOR OPTION REQUIREMENTS WITH ELEVATOR SUPPLIER PRIOR TO INSTALLATION, AND PROVIDE INSTALLATION ACCORDINGLY.
- VERIFY ALL OSHA REQUIREMENTS PRIOR TO CONSTRUCTION.
- FIELD COORDINATE WITH OTHER TRADES AND ENSURE THAT THE ELECTRICAL EQUIPMENT WITHIN THE ELEVATOR EQUIPMENT ROOM IS LOCATED IN COMPLIANCE WITH CEC 620-5.

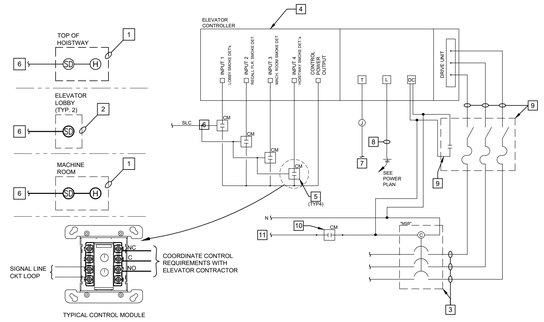


ELEVATOR RECALL CONTROL AND SUPERVISORY SYSTEM RISER DIAGRAM WITH C.B. SHUNT TRIP CONNECTION

WIRING DIAGRAM

ELEV. MOTOR VERIFY SUPPLIED HORSEPOWER

4 — ELECTRICAL, COMMUNICATIONS, AND FIRE ALARM ELEVATOR CONNECTIONS
SCALE: NTS



TYPICAL CONTROL MODULE

☐ REFERENCE NOTES

1. LOCATE HEAT AND SMOKE DETECTORS WITHIN SPECIFIED DISTANCE OF SPRINKLER HEAD. HEAT DETECTOR ACTIVATE PHASE 1 AT ELEVATOR MACHINE ROOM SHALL TRIP ELEVATOR FEEDER BREAKER VIA BREAKER SHUNT TRIP DEVICE. SMOKE DETECTOR AT ELEVATOR MACHINE ROOM SHALL ACTIVATE PHASE 1 RECALL.
2. ACTIVATION OF LOBBY SMOKE DETECTOR SHALL ACTIVATE PHASE 1 RECALL.
3. ELEVATOR MOTOR SHUNT TRIP BREAKER. REFER TO SINGLE LINE DIAGRAM FOR CONDUIT/CONDUCTOR REQUIREMENTS.
4. ELEVATOR DRIVE AND CONTROLLER BY ELEVATOR CONTRACTOR.
5. ADDRESSABLE OUTPUT CONTROL MODULE. PROVIDE (1) FOR EACH PHASE 1 RECALL:
   1. ELEVATOR LOBBY #1 SMOKE DETECTOR
   2. ELEVATOR LOBBY #2 SMOKE BEAM DETECTOR
   3. UPPER ELEVATOR SHAFT SMOKE DETECTOR
   4. ELEVATOR MACHINE ROOM SMOKE DETECTOR

   PROVIDE (1)1/2"C. COORDINATE WITH ELEVATOR CONTRACTOR FOR CONDUCTOR AND TERMINATION REQUIREMENTS.
6. TO FACP. REFER TO FLOOR PLAN.
7. PROVIDE DEDICATED TELEPHONE LINE TO 'MTTB'. CONNECT AT ELEVATOR CONTROLLER.
8. PROVIDE DEDICATED 20A, 120V CIRCUIT FOR ELEVATOR CAR LIGHTS AND CONTROLLER. PROVIDE 20A FUSED DISCONNECT FOR THE CIRCUIT(S) WITHIN THE ELEVATOR EQUIPMENT ROOM. COORDINATE CONNECTION WITH ELEVATOR CONTRACTOR.
9. PROVIDE LOCKABLE AND FUSIBLE, HEAVY DUTY RATED DISCONNECT SWITCH IN ELEVATOR MACHINE ROOM. DISCONNECT SHALL HAVE AUXILIARY CONTACT FOR BATTERY LOWERING DEVICE BYPASS CONTROL. BATTERY LOWERING DEVICE SHALL NOT BE ACTIVATED WHEN DISCONNECT IS IN THE OPEN POSITION. PROVIDE WIRING TO MOTOR CONTROLLER. REFER TO SINGLE LINE DIAGRAM FOR CONDUIT AND CONDUCTOR REQUIREMENTS. PROVIDE CONTROL WIRING TO BATTERY LOWERING DEVICE. COORDINATE WITH ELEVATOR CONTRACTOR FOR REQUIREMENTS.
10. ADDRESSABLE OUTPUT CONTROL MODULE. MODULE SHALL BE ACTIVATED ONLY WHEN HEAT DETECTOR IN UPPER SHAFT OR ELEVATOR EQUIPMENT ROOM HAS BEEN ACTIVATED. CONNECT TO BREAKER SHUNT TRIP AS INDICATED.
11. CONNECT TO BRANCH CIRCUIT SERVING ELEVATOR CONTROLLER.

GENERAL NOTES

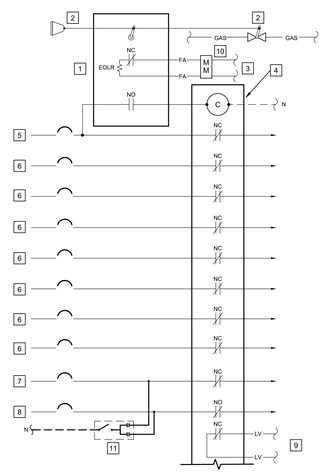
- THE INSTALLATION SHALL BE IN ACCORDANCE WITH NEC ARTICLE 620 AND ANSI A17.1. ELEVATOR CODE.
- SEE LIGHTING AND POWER FLOOR PLANS FOR FURTHER REQUIREMENTS.
- VERIFY ALL OPERATIONAL REQUIREMENTS WITH ELEVATOR CONTRACTOR PRIOR TO INSTALLATION.
- VERIFY ALL OSHA REQUIREMENTS PRIOR TO CONSTRUCTION.
- FIELD COORDINATE WITH OTHER TRADES AND ENSURE THAT THE ELECTRICAL EQUIPMENT WITHIN THE ELEVATOR EQUIPMENT ROOM IS LOCATED IN COMPLIANCE WITH NEC ARTICLE 620-5.
- COORDINATE WORK WITH FIRE ALARM SHOP DRAWINGS.

ELEVATOR BRANCH CIRCUIT SCHEDULE

PANEL	CIRCUITS a	b	c	d	e	f	g	h	i	k	ELEV. NO.
LL2	43	45	47	49	51	53	55	57	59	50/52	L122
LM5	26	28	30	32	34	36	38	18	20	-	M107
LM5	40	42	33	35	37	39	41	22	24	2/4	M150
LQ3	21	23	25	27	29	31	33	37	39	40/42	Q101C
LM2										57/59	M107

DESCRIPTIONS

a -	ELEVATOR EQUIPMENT ROOM LIGHTS/RECEPTACLES	500VA
b -	ELEVATOR CONTROLLER	500VA
c -	ELEVATOR CAB LIGHTS/RECEPTACLES	400VA
d -	ELEVATOR EQUIPMENT ROOM EXHAUST FAN	696VA
e -	ELEVATOR PIT LIGHT/RECEPTACLES	500VA
f -	ELEVATOR PIT (SUMP PUMP)	1176VA
g -	ELEVATOR RECALL CONTROL PANEL	500VA
h-	TOP OF ELEVATOR SHAFT LIGHT	100VA
i-	TOP OF ELEVATOR SHAFT RECEPTACLE	180VA
j-	ELEVATOR VIDEO COMMUNICATIONS EQUIPMENT	500VA
k-	ELEVATOR CONSTRUCTION RECEPTACLE	4000VA



☐ REFERENCE NOTES

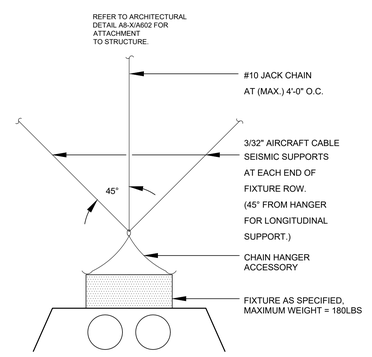
1. HOOD FIRE SUPPRESSION SYSTEM CONTROL PANEL. (BY MC)
2. CABLE PULL SYSTEM RELEASING PRODUCT AND CLOSING GAS VALVE. (BY MC)
3. SUPERVISED FIRE ALARM CIRCUIT, SEE FIRE ALARM RISER DIAGRAM.
4. CONTROL RELAY (SIZE/NUMBER OF POLES AS REQUIRED) IN NEMA 1 ENCLOSURE ABOVE PANEL.
5. BRANCH CIRCUIT TO HOOD LIGHTS. (LIGHTS AUTOMATICALLY "OFF" UPON ACTIVATION OF SYSTEM)
6. BRANCH CIRCUIT(S) TO EQUIPMENT UNDER HOOD. (ALL KITCHEN EQUIPMENT BRANCH CIRCUITS UNDER HOOD TO DE-ENERGIZE AUTOMATICALLY UPON ACTIVATION OF SYSTEM).
7. BRANCH CIRCUIT TO HOOD SUPPLY FAN. (WIRE IN SERIES WITH SUPPLY FAN CONTROL CIRCUIT TO AUTOMATICALLY DE-ENERGIZE SUPPLY UPON ACTIVATION OF SYSTEM.)
8. BRANCH CIRCUIT TO HOOD EXHAUST FAN. (WIRE IN PARALLEL WITH EXHAUST FAN CONTROL CIRCUIT TO AUTOMATICALLY ENERGIZE EXHAUST UPON ACTIVATION OF SYSTEM.)
9. PROVIDE LOW VOLTAGE CONTROL TO HVAC UNIT SERVING SPACE. (UNIT TO AUTOMATICALLY SHUT DOWN UPON ACTIVATION OF SYSTEM)
10. MONITOR MODULE. (SEE FIRE ALARM RISER DIAGRAM)
11. 2-POLE SWITCH FOR ON-OFF CONTROL OF MAU FAN AND KITCHEN EXHAUST FAN. VERIFY EXACT LOCATION WITH MECH. AND FOOD SERVICE EQUIPMENT PLANS.

GENERAL NOTE

1. (1) HOOD SUPPRESSION SYSTEM CONTROL IS REQUIRED FOR EACH CLASS 1 TYPE HOOD PROVIDED.

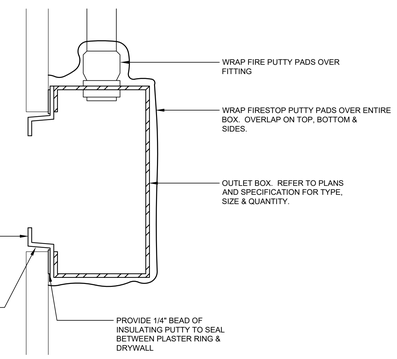
NOTE: INFORMATION SHOWN IS FOR BID PURPOSES ONLY. VERIFY WITH EQUIPMENT SUPPLIER AND APPROVED SHOP DRAWINGS.

1 — TYPICAL HOOD SUPPRESSION SYSTEM WIRING DIAGRAM
SCALE: NTS



2 — TYPICAL CHAIN HUNG FIXTURE MOUNTING
SCALE: NTS

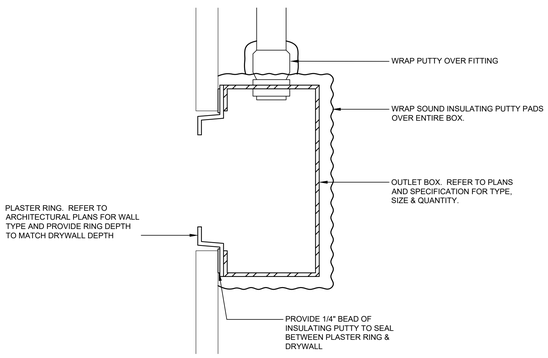
FIRE PUTTY IS NOT REQUIRED IF ONLY ONE BOX IS INSTALLED ON EITHER SIDE OF 100 SF OF WALL.



EQUIPMENT TO BE HILTI, OR 3M.

NOTE:
REFER TO ARCHITECTURAL PLANS FOR ALL RATED WALL LOCATIONS

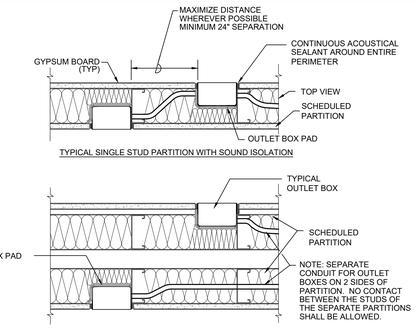
5 — TYPICAL DEVICE INSTALLATION - RATED WALLS
SCALE: NTS



EQUIPMENT TO BE HILTI, OR 3M.

NOTE:
REFER TO ARCHITECTURAL PLANS FOR ALL SOUND RATED PARTITION LOCATIONS

6 — TYPICAL DEVICE INSTALLATION SOUND RATED PARTITIONS
SCALE: NTS



NOTE:
REFER TO ARCHITECTURAL PLANS FOR ALL SOUND RATED PARTITION LOCATIONS

GENERAL NOTES

1. PLACE OUTLET BOXES IN SEPARATE STUD SPACES
2. AVOID BACK-TO-BACK OUTLETS WHEREVER POSSIBLE.
3. PLUG ALL UNUSED KNOCK-OUTS IN OUTLET BOXES WITH KNOCK-OUT CAPS.
4. BACKING EQUIPMENT TO BE HILTI, 3M OR APPROVED EQUAL.
5. DEPTH OF OUTLET BOX MUST BE COMPATIBLE WITH STUD SIZE IN ORDER TO ACCOMMODATE BOX PAD.
6. ACOUSTICAL BOX PAD REQUIREMENT APPLIES TO ALL PARTITIONS WITH ACOUSTICAL INSULATION.
7. INSTALLATION IS TYPICAL FOR ALL OUTLET / BACKBOXES PROVIDED FOR ALL SYSTEMS.

3 — DEVICE SEPARATION - SOUND RATED PARTITIONS
SCALE: NTS

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

General Notes

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EXPIRES: 06/30/25

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Project

TYPICAL INFORMATION

ELECTRICAL DETAILS

Drawing

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LICENSED ARCHITECT — MICHAEL K. FENNO — No. C23724 — Exp. 4-30-27 — STATE OF CALIFORNIA

Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

Designed By:

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Scale: As indicated
Drawn By:

Project Number: 2171
Checked By:

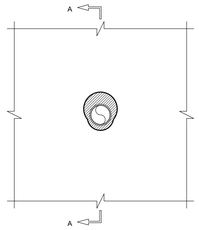
Date: 08/27/24
Reviewed By:

X/E204
AD10

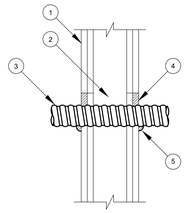
K:\ENG\2022\22-8060\22-8060_XE201-XE208_ELEC DETAILS.dwg - Roger - Oct 01, 2026 - 7:29am

F-RATING = 1-HR. OR 2-HR.
T-RATING = 0-HR.

FRONT VIEW



SECTION A-A



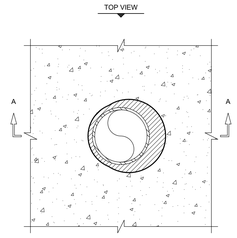
1. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U300 OR U400 SERIES WALL) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
2. (NOT SHOWN). WOOD STUDS TO CONSIST OF NOMINAL 2"x4" LUMBER. STEEL STUDS TO BE MINIMUM 2-1/2" WIDE.
3. PENETRATING ITEM TO BE ONE OF THE FOLLOWING:
   A. MAXIMUM 2" NOMINAL DIAMETER FLEXIBLE STEEL CONDUIT.
   B. MAXIMUM 1" NOMINAL DIAMETER FLEXIBLE STEEL GAS PIPING (WITH OR WITHOUT PLASTIC COVERING) MANUFACTURED BY OMEGA FLEX INC., TITEFLEX CORP., OR WARD MANUFACTURING INC.
4. MINIMUM 5/8" DEPTH HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT.
5. MINIMUM 1/2" BEAD HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT AT POINT OF CONTACT.

NOTES:
1. MAXIMUM DIAMETER OF OPENING = 3-1/2".
2. ANNULAR SPACE = MINIMUM 0", MAXIMUM 1".

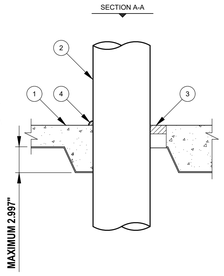
7 FLEXIBLE CONDUIT THRU 1-HR. OR 2-HR. GYPSUM WALL
SCALE: NTS

F-RATING = 2-HR.
T-RATING = 0-HR.

TOP VIEW



SECTION A-A



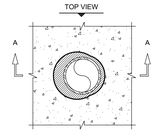
1. NORMAL WEIGHT CONCRETE (MINIMUM 2-1/2" THICK) OVER METAL DECK ASSEMBLY (2-HR. FIRE-RATING).
2. PENETRATING ITEM TO ONE OF THE FOLLOWING:
   A. MAXIMUM 12" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
   B. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE.
   C. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT.
   D. MAXIMUM 4" NOMINAL DIAMETER EMT.
3. MINIMUM 1" DEPTH HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT.
4. MINIMUM 1/2" BEAD HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT APPLIED AT POINT OF CONTACT.

NOTES: SEE STRUCTURAL FOR OPENING DETAIL
1. MAXIMUM DIAMETER OF OPENING = 14-5/8".
2. ANNULAR SPACE = MINIMUM 0", MAXIMUM 1-7/8".

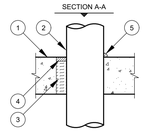
4 METAL PIPE THRU CONCRETE FLOOR OVER METAL DECK
SCALE: NTS

F-RATING = 2-HR.
T-RATING = 0-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM/SQ. FT.
L-RATING AT 400° F = 4 CFM/SQ. FT.
W-RATING = CLASS I (SEE NOTE NO. 4 BELOW)

TOP VIEW



SECTION A-A



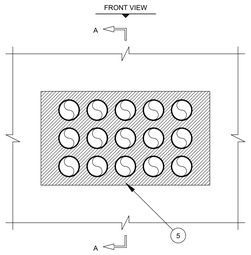
1. CONCRETE FLOOR OR WALL ASSEMBLY (2-HR. FIRE-RATING):
   A. ANY LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MINIMUM 4-1/2" THICK).
   B. ANY UL/cUL CLASSIFIED CONCRETE BLOCK WALL.
2. PENETRATING ITEM TO BE ONE OF THE FOLLOWING:
   A. MAXIMUM 10" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
   B. MAXIMUM 10" NOMINAL DIAMETER CAST IRON PIPE.
   C. MAXIMUM 4" NOMINAL DIAMETER COPPER PIPE OR TUBING.
   D. MAXIMUM 4" NOMINAL DIAMETER STEEL CONDUIT.
   E. MAXIMUM 4" NOMINAL DIAMETER EMT.
3. MINIMUM 3" THICKNESS MINERAL WOOL (MINIMUM 4 PCF DENSITY) TIGHTLY PACKED FOR NOMINAL 4" DIAMETER (AND SMALLER), AND MINIMUM 4" THICKNESS MINERAL WOOL (MINIMUM 4 PCF DENSITY) TIGHTLY PACKED FOR PIPES GREATER THAN NOMINAL 4" DIAMETER.
4. MINIMUM 1/2" DEPTH HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT, CP 601S ELASTOMERIC FIRESTOP SEALANT, CP 604 SELF-LEVELING FIRESTOP SEALANT, OR CP 606 FLEXIBLE FIRESTOP SEALANT.
5. MINIMUM 1/2" BEAD HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT, CP 601S ELASTOMERIC FIRESTOP SEALANT, OR CP 606 FLEXIBLE FIRESTOP SEALANT APPLIED AT POINT OF CONTACT. (NOT REQUIRED WHEN CP 604 SELF-LEVELING FIRESTOP SEALANT IS USED, ITEM NO. 4).

NOTES :
1. MAXIMUM DIAMETER OF OPENING = 12".
2. ANNULAR SPACE = MINIMUM 0", MAXIMUM 1-1/4".
3. MINIMUM 1/2" DEPTH HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT, CP 601S ELASTOMERIC FIRESTOP SEALANT, OR CP 606 FLEXIBLE FIRESTOP SEALANT IS REQUIRED ON BOTH SIDES OF A WALL ASSEMBLY.
4. W-RATING APPLIES ONLY WHEN CP 601S ELASTOMERIC FIRESTOP SEALANT OR CP 604 SELF-LEVELING FIRESTOP SEALANT IS USED.

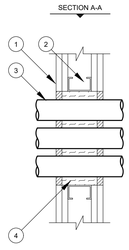
1 METAL PIPE THROUGH CONCRETE OR BLOCK WALL/FLOOR
SCALE:

F-RATING = 1-HR. OR 2-HR.
T-RATING = 1/2-HR.

FRONT VIEW



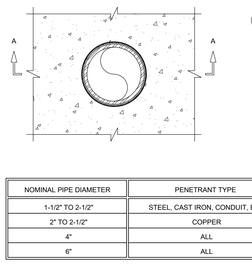
SECTION A-A



1. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U300 OR U400 SERIES) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
2. WOOD STUDS TO CONSIST OF NOMINAL 2" x 4" LUMBER. STEEL STUDS TO BE MINIMUM 2-1/2" WIDE. OPENING TO BE "FRAMED-OUT".
3. ONE OR MORE MAXIMUM 2" NOMINAL DIAMETER EMT OR STEEL CONDUIT.
4. MINIMUM 2-1/2" OR 2-3/4" THICKNESS MINERAL WOOL (MINIMUM 4 PCF DENSITY) TIGHTLY PACKED FOR 1-HR. OR 2-HR. FIRE-RATING, RESPECTIVELY.
5. MINIMUM 5/8" DEPTH HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT.

NOTES:
1. MAXIMUM SIZE OF OPENING = 18" x 10". MAXIMUM WIDTH BETWEEN WOOD STUD WALLS IS LIMITED TO 14-1/2".
2. ANNULAR SPACE BETWEEN PIPES AND PERIPHERY OF OPENING = MINIMUM 1/2", MAXIMUM 2-3/8".
3. ANNULAR SPACE BETWEEN PIPES = MINIMUM 1/2", MAXIMUM 5/8".
4. EMT OR STEEL CONDUIT MAY BE INSTALLED AT AN ANGLE NOT GREATER THAN 45° FROM PERPENDICULAR.

8 MULTIPLE METAL PIPES THRU 1-HR. OR 2-HR. GYP WALL
SCALE: NTS



NOMINAL PIPE DIAMETER	PENETRANT TYPE	PRODUCT DESCRIPTION
1-1/2" TO 2-1/2"	STEEL, CAST IRON, CONDUIT, EMT	CP 680 75/2.5" N or CP 682 75/2.5"
2" TO 2-1/2"	COPPER	CP 680 75/2.5" N or CP 682 75/2.5"
4"	ALL	CP 680 110/4" N or CP 682 110/4"
6"	ALL	CP 680 160/6" N

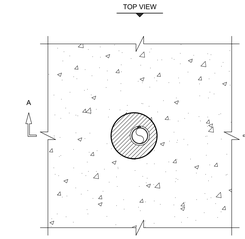
1. CONCRETE FLOOR ASSEMBLY (2-HR. FIRE-RATING):
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 2-1/2" THICK).
   B. STEEL FLOOR UNIT/FLOOR ASSEMBLY - NORMAL WEIGHT CONCRETE FLOOR (MINIMUM 2-1/2" THICK) OVER METAL DECKING.
2. PENETRATING ITEM TO BE ONE OF THE FOLLOWING:
   A. MAXIMUM 6" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
   B. MAXIMUM 6" NOMINAL DIAMETER CAST IRON PIPE.
   C. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE.
   D. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT.
   E. MAXIMUM 4" NOMINAL DIAMETER EMT.
3. HILTI CP 680N OR CP 682 CAST-IN FIRESTOP DEVICE CAST OR GROUTED INTO CONCRETE FLOOR (SEE TABLE BELOW).

NOTES:
1. FOR CONCRETE FLOOR OVER METAL DECKING APPLICATIONS, A CAST-IN METAL DECK ADAPTER IS REQUIRED.
2. WHEN PIPE DIAMETER IS SMALLER THAN INDICATED ABOVE, A MINIMUM 1" THICKNESS HILTI CP 618 FIRESTOP PUTTY STICK SHALL BE APPLIED WITHIN THE ANNULUS BETWEEN THE PIPE AND PERIPHERY OF HILTI CP 680N OR CP 682 CAST-IN FIRESTOP DEVICE, FLUSH WITH TOP SURFACE OF DEVICE.
3. AS AN ALTERNATE TO HILTI CP 618, MINIMUM 4" THICKNESS MINERAL WOOL (MINIMUM 4 PCF DENSITY) MAY BE TIGHTLY PACKED INTO HILTI CP 680N OR CP 682, FLUSH WITH TOP SURFACE OF DEVICE.

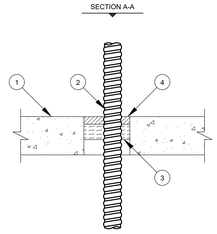
5 METAL PIPE THRU CONC FLOOR/ CONC OVER METAL DECK
SCALE: NTS

F-RATING = 2-HR.
T-RATING = 0-HR.

TOP VIEW



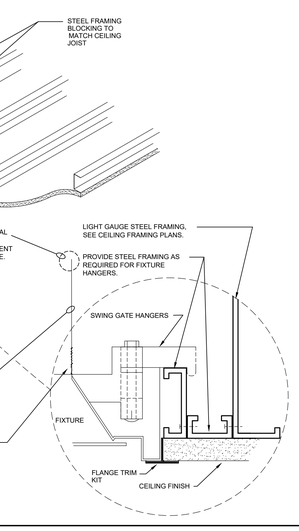
SECTION A-A



1. CONCRETE FLOOR ASSEMBLY (2-HR. FIRE-RATING):
   A. LIGHTWEIGHT OR NORMAL WEIGHT CONCRETE FLOOR OR WALL (MINIMUM 2-1/2" THICK).
   B. ANY UL/cUL CLASSIFIED CONCRETE BLOCK WALL.
2. PENETRATING ITEM TO BE ONE OF THE FOLLOWING:
   A. MAXIMUM 1" NOMINAL DIAMETER FLEXIBLE STEEL CONDUIT.
   B. MAXIMUM 1" NOMINAL DIAMETER FLEXIBLE STEEL GAS PIPING (WITH OR WITHOUT PLASTIC COVERING) MANUFACTURED BY OMEGA FLEX INC., TITEFLEX CORP., OR WARD MFG. INC.
3. MINIMUM 1" THICKNESS MINERAL WOOL (MINIMUM 4 PCF DENSITY) TIGHTLY PACKED.
4. MINIMUM 1/2" DEPTH HILTI FS-ONE INTUMESCENT FIRESTOP SEALANT.

NOTES :
1. MAXIMUM DIAMETER OF OPENING = 3".
2. ANNULAR SPACE = MINIMUM 1/2", MAXIMUM 1-1/4".

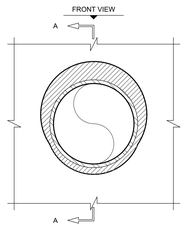
2 FLEXIBLE CONDUIT THRU CONC FLOOR/WALL, BLOCK WALL
SCALE: NTS



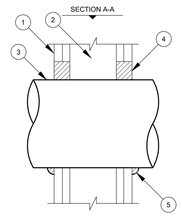
9 FLANGED FIXTURE MOUNTING
SCALE: NTS

F-RATING = 1-HR. OR 2-HR.
T-RATING = 0-HR.
L-RATING AT AMBIENT = LESS THAN 1 CFM/SQ FT.
L-RATING AT 400°F = LESS THAN 1 CFM/SQ FT.

FRONT VIEW



SECTION A-A



1. GYPSUM WALL ASSEMBLY (UL/cUL CLASSIFIED U300, U400, OR V400 SERIES) (1-HR. OR 2-HR. FIRE-RATING) (2-HR. SHOWN).
2. (NOT SHOWN). WOOD STUDS TO CONSIST OF NOMINAL 2" x 4" LUMBER. STEEL STUDS TO BE MINIMUM 2-1/2" WIDE.
3. PENETRATING ITEM TO BE ONE OF THE FOLLOWING:
   A. MAXIMUM 30" NOMINAL DIAMETER STEEL PIPE (SCHEDULE 10 OR HEAVIER).
   B. MAXIMUM 30" NOMINAL DIAMETER CAST IRON OR DUCTILE IRON PIPE.
   C. MAXIMUM 6" NOMINAL DIAMETER COPPER PIPE OR TUBING.
   D. MAXIMUM 6" NOMINAL DIAMETER STEEL CONDUIT.
   E. MAXIMUM 4" NOMINAL DIAMETER EMT.
4. HILTI CP 606 FLEXIBLE FIRESTOP SEALANT:
   A. MINIMUM 5/8" DEPTH OF SEALANT FOR A 1-HR. FIRE-RATING.
   B. MINIMUM 1-1/4" DEPTH OF SEALANT FOR A 2-HR. FIRE-RATING.
5. MINIMUM 1/2" BEAD HILTI CP 606 FLEXIBLE FIRESTOP SEALANT APPLIED AT POINT OF CONTACT.

NOTES:
1. MAXIMUM DIAMETER OF OPENING = 32".
2. ANNULAR SPACE IN 1-HR. WALLS = MINIMUM 0", MAXIMUM 1".
3. ANNULAR SPACE IN 2-HR. WALLS = MINIMUM 0", MAXIMUM 2".
4. PENETRANT MAY BE INSTALLED AT AN ANGLE NOT GREATER THAN 45° FROM PERPENDICULAR.

6 METAL PIPE THROUGH 1-HR. OR 2-HR. GYPSUM WALL
SCALE: NTS

3 NOT USED
SCALE:

9

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

General Notes

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EXPIRES: 06/30/25

Consultant THOMA #22-8060

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Sanger Unified School District
1760 S Fowler Ave, Fresno CA 93727
Project

TYPICAL INFORMATION

ELECTRICAL DETAILS
Drawing

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ARCHITECTURE PLANNING INTERIORS
www.dardenarchitects.com
6790 N. West Ave. • Fresno, CA 93711 • T. 559.448.8051

LICENSED ARCHITECT JEFFREY K. T. FENG No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

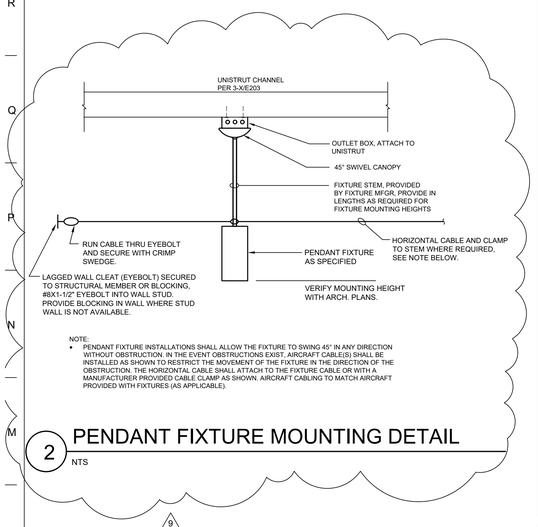
Designed By:
Drawn By:
Checked By:
Reviewed By:

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Scale: As indicated
Project Number: 2171
Date: 08/27/24

X/E205
AD10

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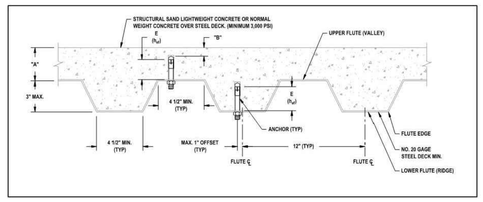


NOTE:
- PENDANT FIXTURE INSTALLATIONS SHALL ALLOW THE FIXTURE TO SWING 45° IN ANY DIRECTION WITHOUT OBSTRUCTION. IN THE EVENT OBSTRUCTIONS EXIST, AIRCRAFT CABLE(S) SHALL BE INSTALLED AS SHOWN TO RESTRICT THE MOVEMENT OF THE FIXTURE IN THE DIRECTION OF THE OBSTRUCTION. THE HORIZONTAL CABLE SHALL ATTACH TO THE FIXTURE CABLE OR WITH A MANUFACTURER PROVIDED CABLE CLAMP AS SHOWN. AIRCRAFT CABLING TO MATCH AIRCRAFT PROVIDED WITH FIXTURES (AS APPLICABLE).

2 PENDANT FIXTURE MOUNTING DETAIL
NTS

9

W3 TYPE DECKS INFORMATION



WEDGE ANCHOR TYPE	MIN. CONCRETE FILL COVER "A"	ICC-ES ESR #	ANCHOR DIA.	COVER "B"
HILTI KB-TZ2	3 1/4"	1917	3/8", 1/2", 5/8"	5/8"
SIMPSON STRONG BOLT SB-2	3 1/4"	3037	1/2", 5/8"	1/2"
POWERS POWER-STUD+ SD2	3 1/4"	2522	3/8", 1/2", 5/8", 3/4"	3/4"

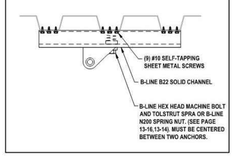
NOTES:
1.) LOADING SHALL ALSO NOT EXCEED VALUES LISTED ON 12/X/S532

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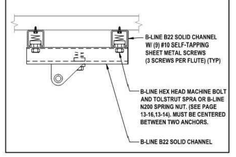
EATON Powering Business Worldwide — EATON'S B-LINE BUSINESS, 509 WEST MONROE STREET | HIGHLAND, IL 62249, P: (866) 851-7415 | F: (800) 356 1438
Structural Engineer: Mohammad Hariri, California SE No. S3545
PAGE: 11-68
DATE: NOVEMBER 29, 2016

SCREWS TO 18 GA. MIN. METAL DECK WITH NO CONCRETE FILL

SHOWN WITH 900 SERIES ATTACHMENT PERPENDICULAR TO FLUTES



SHOWN WITH 900 SERIES ATTACHMENT PARALLEL TO FLUTES



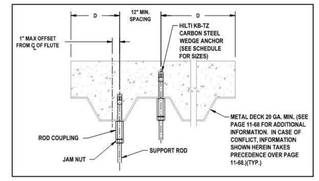
ALLOWABLE STRENGTH DESIGN (ASD) MAX. HORIZONTAL LOAD BRACE ANGLE MEASURED FROM HORIZONTAL (LB)						
PERPENDICULAR			PARALLEL			
0° - 30°	31° - 45°	46° - 60°	0° - 30°	31° - 45°	46° - 60°	
100	100	100	100	100	100	

NOTES:
1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) STRUT NUTS MAY BE USED INSTEAD OF SPRING NUTS AS SHOWN.
3.) SCREWS SHALL BE 1" MIN. LONG.
4.) SCREWS SHALL BE SPACED AT 5/8" MINIMUM SPACING WITH 3/8" MIN. EDGE DISTANCE.
5.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
6.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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Structural Engineer: Mohammad Hariri, California SE No. S3545
PAGE: 11-40
DATE: NOVEMBER 29, 2016

SINGLE HILTI KT-TZ2 ANCHOR VERTICAL SUPPORT CONNECTION IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE



ANCHOR DIA.	"E" MIN. EFFECTIVE EMBED. DEPTH h_{ef}	"D" MIN. EDGE DISTANCE	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	ALLOWABLE STRENGTH DESIGN (ASD) MAX. VERTICAL LOAD SINGLE (LB)
3/8"	2"	6 3/4"	12"	210
1/2"	2"	6 3/4"	12"	210
1/2"	3 1/4"	9 3/4"	12"	375
5/8"	3 1/8"	9 3/8"	12"	288
5/8"	4"	12"	12"	665

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

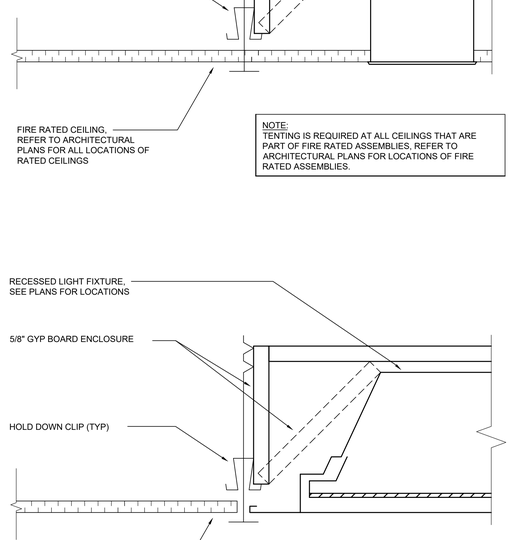
LOADING SHALL ALSO NOT EXCEED VALUES LISTED ON 12/X/S532

NOTES:
1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.3.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-68 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-4266 (2013)

NOTES CONTINUED:
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-4266 (2013. REFER TO METAL DECK DIMENSIONS SHOWN ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE, LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) NOT USED.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.
13.) LOADING SHALL ALSO NOT EXCEED VALUES LISTED ON 12/X/S532

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Structural Engineer: Mohammad Hariri, California SE No. S3545
PAGE: 11-7
DATE: NOVEMBER 29, 2016



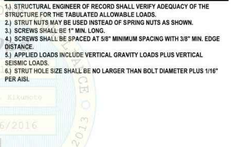
1 TENTING AT RECESSED LIGHTING FIXTURES
SCALE: NTS

SCREWS TO 18 GA. MIN. METAL DECK WITH NO CONCRETE FILL

SHOWN WITH 900 SERIES ATTACHMENT PERPENDICULAR TO FLUTES



SHOWN WITH 900 SERIES ATTACHMENT PARALLEL TO FLUTES



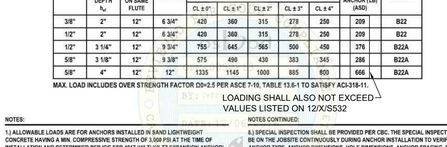
ALLOWABLE STRENGTH DESIGN (ASD)
MAX. VERTICAL LOAD (LB)
PERPENDICULAR / PARALLEL
100 / 100

NOTES:
1.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.
2.) STRUT NUTS MAY BE USED INSTEAD OF SPRING NUTS AS SHOWN.
3.) SCREWS SHALL BE 1" MIN. LONG.
4.) SCREWS SHALL BE SPACED AT 5/8" MINIMUM SPACING WITH 3/8" MIN. EDGE DISTANCE.
5.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
6.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.

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Structural Engineer: Mohammad Hariri, California SE No. S3545
PAGE: 11-41
DATE: NOVEMBER 29, 2016

DUAL HILTI KT-TZ2 ANCHOR VERTICAL SUPPORT CONNECTION IN 3,000 PSI SAND LIGHTWEIGHT CONCRETE



ANCHOR DIA.	"E" MIN. EFFECTIVE EMBED. DEPTH h_{ef}	MIN. SPACING BETWEEN ANCHORS ON SAME FLUTE	MIN. EDGE DISTANCE	TWO ANCHOR CONNECTION (ASD) COMBINED TOTAL ALLOWABLE ROD TENSION DESIGN VALUE (Lbs.) VERTICAL SUPPORT ROD MAX. OFFSET FROM ℄ (LB) CL ± 0":	CL ± 1":	CL ± 2"	CL ± 3"	CL ± 4"	MAX. ALLOWABLE LOAD ON SINGLE ANCHOR (LB) (ASD)	B-LINE SOLID CHANNEL
3/8"	2"	12"	6 3/4"	420	360	315	278	250	209	B22
1/2"	2"	12"	6 3/4"	420	360	315	278	250	209	B22
1/2"	3 1/4"	12"	9 3/4"	755	645	565	500	450	376	B22A
5/8"	3 1/8"	12"	9 3/8"	575	490	430	383	345	286	B22A
5/8"	4"	12"	12"	1335	1145	1000	885	800	666	B22A

MAX. LOAD INCLUDES OVER STRENGTH FACTOR Ω0=2.5 PER ASCE 7-10, TABLE 13.6-1 TO SATISFY ACI-318-11.

LOADING SHALL ALSO NOT EXCEED VALUES LISTED ON 12/X/S532

NOTES:
1.) ALLOWABLE LOADS ARE FOR ANCHORS INSTALLED IN SAND LIGHTWEIGHT CONCRETE HAVING A MIN. COMPRESSIVE STRENGTH OF 3,000 PSI AT THE TIME OF INSTALLATION AND DETERMINED PER ICC ESR-1917 (HILTI KB-TZ EXPANSION ANCHOR) FOR ANCHORS IN CRACKED CONCRETE. ALLOWABLE LOADS HAVE BEEN MULTIPLIED BY 0.75 PER ACI 318-11 APPENDIX D, D3.3.4.4 AND INTERACTION BASED ON D.7.3.
2.) FOR ESSENTIAL FACILITIES, 50 PERCENT OF THE EXPANSION TYPE ANCHORS (ALTERNATE ANCHORS IN ANY GROUP ARRANGEMENT) SHALL BE PROOF TESTED TO TWICE THE ALLOWABLE CAPACITY IN TENSION. IF ANY ANCHOR FAILS, 20 CONSECUTIVE ANCHORS INSTALLED BY THE SAME TRADE MUST THEN ALSO BE TESTED BEFORE RESUMING 50 PERCENT TESTING. TESTING SHOULD OCCUR 24 HOURS MINIMUM AFTER INSTALLATION OF ANCHOR. SEE PAGE 11-68 FOR TESTING REQUIREMENTS.
3.) FOLLOW ALL WEDGE ANCHOR INSTALLATION REQUIREMENTS PER ICC ESR-1917 (2013)
4.) MINIMUM CONCRETE THICKNESS SHALL COMPLY WITH ICC ESR-4266 (2013. REFER TO METAL DECK DIMENSIONS ABOVE.
5.) WHEN INSTALLING ANCHORS IN REINFORCED CONCRETE, AVOID DAMAGING REINFORCING STEEL.
6.) WHEN INSTALLING ANCHORS IN PRESTRESSED CONCRETE, LOCATE PRESTRESSING STEEL AND AVOID DAMAGING PRESTRESSING STEEL.
7.) STRUCTURAL ENGINEER OF RECORD SHALL VERIFY ADEQUACY OF THE STRUCTURE FOR THE TABULATED ALLOWABLE LOADS.

NOTES CONTINUED:
8.) SPECIAL INSPECTION SHALL BE PROVIDED PER CBC. THE SPECIAL INSPECTOR MUST BE ON THE JOBSITE CONTINUOUSLY DURING ANCHOR INSTALLATION TO VERIFY ANCHOR TYPE, ANCHOR DIMENSIONS, HOLE DIMENSIONS, ANCHOR SPACING, EDGE DISTANCES, SLAB THICKNESS, ANCHOR EMBEDMENT AND TIGHTENING TORQUE. TEST REPORT OF THE RESULTS SHALL BE SUBMITTED TO OSHPD.
9.) HANGER ROD DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE ANCHOR DIAMETER.
10.) IF ALLOWABLE LOAD FOR ONE ANCHOR IS USED, HANGER ROD MAY BE OFFSET ANYWHERE BETWEEN THE TWO ANCHORS.
11.) APPLIED LOADS INCLUDE VERTICAL GRAVITY LOADS PLUS VERTICAL SEISMIC LOADS.
12.) NOT USED.
13.) STRUT HOLE SIZE SHALL BE NO LARGER THAN BOLT DIAMETER PLUS 1/16" PER AISI.
14.) HOLE DIAMETER THROUGH METAL DECK MAY NOT EXCEED ANCHOR HOLE DIAMETER BY MORE THAN 1/8" PER ICC-ESR.
15.) LOADING SHALL ALSO NOT EXCEED VALUES LISTED ON 12/X/S532

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Structural Engineer: Mohammad Hariri, California SE No. S3545
PAGE: 11-8
DATE: NOVEMBER 29, 2016

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

General Notes

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REGISTERED PROFESSIONAL ENGINEER WILLIAM A. THOMA ELECTRICAL STATE OF CALIFORNIA
EXPIRES: 06/30/25
Consultant THOMA #22-8060

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Sanger Unified School District
1760 S Fowler Ave, Fresno CA 93727
Project

ELECTRICAL DETAILS
Drawing

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Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

Designed By:
Drawn By:
Checked By:
Reviewed By:

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Scale: As indicated
Project Number: 2171
Date: 08/27/24

X/E208
AD10

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LIGHTING CONTROL SYSTEM GENERAL NOTES

ON DIGITAL SYSTEMS, ALL DEVICES TO BE CONNECTED IN A DAISY CHAIN PATTERN; LAST DEVICE SHALL NOT BE LOOPED BACK TO FIRST DEVICE.

ON DIGITAL SYSTEMS, CONTRACTOR SHALL NOTE AND LABEL ADDRESS AND LOCATION OF EACH DEVICE ON THE SYSTEM ONE-LINE DIAGRAMS OR SYSTEM LAYOUT DRAWINGS AT TIME OF INSTALLATION.

ONE-LINE DIAGRAMS INDICATE THE REQUIRED GROUPING OF WIRES, NOT THE NUMBER OR SIZE OF CONDUITS.

WIRING SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE (NEC) AND APPLICABLE LOCAL CODES, INCLUDING PROVISION OF EQUIPMENT GROUNDING AS REQUIRED BY THE NEC.

POWER CONDUCTORS SHALL BE SIZED PER THE NEC AMPACITY TABLES (ARTICLE 310), INCLUDING ADJUSTMENT FACTOR AND NEUTRAL CONDUCTOR REQUIREMENTS (FEED AND BRANCH NEUTRAL CONDUCTORS MUST BE COUNTED AS CURRENT CARRYING CONDUCTORS). RUN SEPARATE NEUTRAL CONDUCTORS FOR EACH LINE VOLTAGE/PHASE DIMMED LOAD.

FOR 0-10VDC DIMMING SYSTEMS, VIOLET AND GRAY CONDUCTORS ARE FOR 0-10VDC LOW VOLTAGE TERMINATIONS ONLY. NEVER TERMINATE LINE VOLTAGE (120/230/277VAC) TO VIOLET AND GRAY.

CONTRACTOR IS RESPONSIBLE FOR ALL CONTROL TERMINATIONS. NO SPLICES ARE PERMITTED IN CONTROL WIRING.

POWER AND CONTROL CONDUCTORS MUST NOT SHARE THE SAME RACEWAY OR CONDUIT EXCEPT WHERE SPECIALIZED CABLE TYPES ARE USED THAT SUPPORT SUCH INSTALLATIONS, AS SUPPORTED BY CABLE MANUFACTURER.

LIGHTING CONTROL EQUIPMENT MUST BE INSTALLED, MAINTAINED, AND OPERATED IN AN "OFFICE CLEAN" DRY ENVIRONMENT, INDOOR DRY LOCATIONS ONLY, 10% - 90% RELATIVE HUMIDITY; AMBIENT TEMPERATURE 0°- 40°C (32°-104°F) - 0°- 35°C (32°- 95°F) RECOMMENDED.

SENSORS IN ELECTRICAL/MECHANICAL LOCATIONS NEED TO BE VERIFIED WITH AUTHORITY HAVING JURISDICTION. REFER TO NEC 110.26.D.

RELAY AND DIMMER PANEL SCHEDULES SHOULD CONTAIN BREAKER PANEL INPUTS AS WELL AS ZONES/AREAS CONTROLLED.

VERIFY MAXIMUM CABLE LENGTHS BASED ON CONTROL SYSTEM. MANUFACTURER IS NOT RESPONSIBLE FOR SYSTEMS EXCEEDING CABLING PARAMETERS.

CAT. 5 CABLE MUST BE INSTALLED AT LEAST 12 INCHES FROM ALL LINE VOLTAGE CONDUCTORS EXCEPT TO CROSS OR MAKE TERMINATIONS. CAT. 5 CABLE MUST BE KEPT AWAY FROM ALL EMF DEVICES SUCH AS BALLASTS OR TRANSFORMERS.

0-10V DIMMING BALLASTS AND DRIVERS ARE REQUIRED TO COMPLY WITH IEC 60929 ANNEX E SPECIFICATIONS.

ONE POWER PACK IS NEEDED PER CIRCUIT/ZONE TO BE CONTROLLED BY A MAXIMUM OF 14 LOW VOLTAGE SENSORS. POWER
PACK PLACEMENT ON DRAWINGS IS FOR COUNTING ONLY. FINAL PLACEMENT OF POWER PACK IS UP TO CONTRACTOR/ENGINEER. PLEASE RECHECK COUNTS TO VERIFY THE NUMBER OF POWER PACKS NEEDED TO MAKE A COMPLETE SYSTEM. THE MAXIMUM NUMBER OF POWER PACKS THAT CAN BE CONTROLLED BY A GROUP OF SENSORS IS 5. IF
YOU HAVE MORE THEN 5 CIRCUITS CONTROLLING A SPACE YOU WILL EITHER HAVE TO BREAK UP THE SPACE INTO ZONES OR
USE ONE POWER PACK PER LIGHTING CONTACTOR TO PULL IN THE CIRCUITS.

SENSOR PLACEMENT AND TYPES WERE PLACED WITH CURRENT PROJECT INFORMATION. ADDITIONAL SENSORS AND TYPES
OF SENSORS MAY BE REQUIRED TO PROVIDE COMPLETE COVERAGE DEPENDING ON DRAWING CHANGES, EMS/BMS, FINAL
PARTITION HEIGHT/PLACEMENT, FURNITURE PLACEMENT, EQUIPMENT HEIGHT/PLACEMENT AND SHELVING HEIGHT/PLACEMENT.

FOR MAXIMUM DISTANCE USING CEILING MOUNTED 360° SENSORS ROTATE THE SENSOR CLOCKWISE SO THAT THE SCREW
AXIS IS POSITIONED 7.5° OFF THE ENTRANCE AXIS. WHEN WALKING ACROSS A SENSOR'S BEAM, DETECTION WILL OCCUR AT
APPROXIMATELY LONGEST DISTANCE. (REFER TO SPECIFICATION SHEET FOR PICTORIAL OF ALIGNMENT)

SENSOR MASKING KITS MAY BE REQUIRED TO LIMIT COVERAGE DEPENDING ON YOUR REQUIREMENTS.

MAXIMUM CABLE LENGTH FROM START DEVICE TO END DEVICE IS 1800'. MANUFACTURER IS NOT RESPONSIBLE FOR SYSTEMS
EXCEEDING CABLING PARAMETERS.

nLight System Notes

EVERY NLIGHT ENABLED DEVICE (INCLUDING NLIGHT ENABLED FIXTURES) IS FURNISHED WITH (1) PERMANENTLY ADHERED ID TAG AND (1) MATCHING, PARTIALLY ADHERED ID TAG TO BE PLACED ON THE RISER DIAGRAM SHEET, OR THE LIGHTING CONTROL LAYOUT SHEET, PROVIDED AS PART OF AN NLIGHT SUBMITTAL. THIS SHALL BE DONE DURING INSTALLATION AND PRIOR TO FACTORY STARTUP. FAILURE TO COMPLY MAY RESULT IN STARTUP DELAYS AND ADDITIONAL COSTS AT THE CONTRACTOR'S EXPENSE. DO NOT PLACE DEVICE ID STICKERS ON FLOOR PLAN UNLESS REQUIRED TO EXECUTE NFLOORPLAN OR ENVYSION SERVICES. REFERENCE NFLOORPLAN SERVICE NOTES OR ENVYSION SERVICE NOTES ON THIS SHEET FOR SPECIFIC REQUIREMENTS.

ONE RELAY PACK OR NLIGHT ENABLED FIXTURE IS NEEDED PER CIRCUIT/ZONE TO BE CONTROLLED AND CAN RESIDE WITHIN SENSORS, WALLPODS, OR RELAY PACKS. POWER PACK PLACEMENT ON DRAWINGS IS FOR COUNTING ONLY; FINAL PLACEMENT IS UP TO DISCRETION OF CONTRACTOR/ENGINEER. PLEASE RECHECK COUNTS TO VERIFY THE NUMBER OF RELAYS NEEDED TO SWITCH ALL DESIRED LOADS. RELAY PACKS AND POWER SUPPLIES REQUIRE A CONSTANT HOT. A SWITCHED HOT BEING SUPPLIED TO RELAY PACKS MAY RESULT IN COMMUNICATION LOSS WHEN POWER IS NOT AVAILABLE.

BRIDGES, RELAYS, POWER PACKS, WALLPODS, AND SENSORS ON DRAWINGS WERE PLACED WITH INFORMATION PROVIDED AT TIME OF DESIGN. ADDITIONAL BRIDGES AND/OR SENSORS MAY BE REQUIRED DEPENDING ON BUILDING CHANGES, FINAL PARTITION HEIGHT/PLACEMENT, FURNITURE PLACEMENT, EQUIPMENT HEIGHT/PLACEMENT AND SHELVING HEIGHT/PLACEMENT.

THE LAYOUT OF THE NETWORK BACKBONE (BRIDGES AND GATEWAYS) HAS BEEN PLACED IN A SEPARATE TREE DIAGRAM AND NOT ON THE ACTUAL LAYOUT. FINAL PLACEMENT OF THE BRIDGE(S) AND GATEWAY(S) DEVICES SHALL BE AT THE CONTRACTOR/ENGINEER DISCRETION.

ALL DEVICES HAVE RJ-45 FEMALE PORTS. MAKING NETWORK CONTROL CABLES IS REQUIRED, T568B TERMINATIONS ARE RECOMMENDED. IT IS IMPERATIVE THAT ALL NETWORK CONTROL CABLES BE TESTED WITH A LAN CABLE TESTER TO VERIFY PROPER TERMINATIONS.

DAISY-CHAINED DEVICES SHOULD BE POWERED UP AND WORKING ON DEFAULT PROGRAMMING PRIOR TO CONNECTION TO BRIDGE OR GATEWAYS.

LOW VOLTAGE NETWORK CONTROL CABLE (CAT5/5E/6) RUNS FOR LOCAL ZONES, HOMERUNS AND BACKBONE SHOULD BE WHITE WITH CABLES LABELED.

CONTRACTOR TO VERIFY BLINK/DIAGNOSTIC CODES (VISIT HTTP://NLIGHTCONTROLS.COM/WP-CONTENT/UPLOADS/NLIGHT_POCKET_GUIDE.PDF) WHEN CONNECTING GATEWAYS/BRIDGES TO ZONES.

MAXIMUM CABLE LENGTH FROM START DEVICE TO END DEVICE IS 1500' INCLUDING HOMERUN TO BRIDGE DEVICE, IF PRESENT. MANUFACTURER IS NOT RESPONSIBLE FOR SYSTEMS EXCEEDING CABLING PARAMETERS.

nLight Air System Notes

INITIAL NETWORKED NLIGHT AIR DEVICES SHOULD BE LOCATED WITHIN 100 FEET OF AN NLIGHT AIR ADAPTER IN INDOOR APPLICATIONS, UNLESS A SITE SURVEY HAS BEEN DONE TO CONFIRM OTHERWISE.

FOR MAXIMUM RANGE, THE NLIGHT AIR ADAPTER, WHICH IS USED FOR NETWORK COMMUNICATION, SHOULD BE MOUNTED IN AN OPEN INDOOR AREA (SUCH AS A CORRIDOR) AND SHOULD NOT BE LOCATED IN AN ENCLOSED SPACE (SUCH AS AN ELECTRICAL CLOSET).

A MAXIMUM 1,000 FOOT, LINE-OF-SIGHT DISTANCE SHOULD BE USED FOR OUTDOOR APPLICATIONS WHERE LINE OF SIGHT IS AVAILABLE BETWEEN THE NLIGHT AIR ADAPTER AND DEVICES RECEIVING AN INITIAL BROADCAST.

AN NLIGHT ECLYPSE WITH CONNECTED NLIGHT AIR ADAPTER CAN SUPPORT 750 DEVICES TOTAL. STANDALONE NLIGHT AIR GROUPS CAN CONTAIN UP TO 128 NLIGHT AIR DEVICES, AND ALL DEVICES SHOULD BE LOCATED WITHIN A MAXIMUM OF 1,000 FEET CLEAR LINE-OF-SIGHT OF EACH DEVICE WITHIN THE GROUP.

SOME CEILING MOUNTED NLIGHT AIR SENSORS WILL REQUIRE A CONNECTION TO A POWER SUPPLY OR NLIGHT AIR POWER PACK FOR LOW VOLTAGE POWER. SEE THE RCMS SPECIFICATION SHEETS FOR MORE INFORMATION. BATERY POWERED SENSORS ARE AVAILABLE FOR INDOOR APPLICATIONS (RCMSB SENSORS). SEE THE RCMSB SPECIFICATION SHEETS FOR MORE INFORMATION.

SOME BATTERY POWERED NLIGHT AIR SWITCHES AND CEILING MOUNTED SENSORS (RPODB AND RCMSB SERIES) INCLUDE AN INTERNAL BATTERY, RATED FOR A 10-YEAR LIFE EXPECTANCY. LINE-VOLTAGE POWERED SWITCHES ARE AVAILABLE. SEE THE RPOD SPECIFICATION SHEET FOR MORE INFORMATION ON AVAILABLE OPTIONS.

NLIGHT AIR DEVICES MUST BE PROGRAMMED THROUGH THE CLARITY PRO MOBILE APPLICATION BEFORE THEY CAN BE CONTROLLED OR NETWORKED TO AN NLIGHT ECLYPSE WITH CORRESPONDING NLIGHT AIR ADAPTER.

DSA File No.:
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☐ Sheet Reference Notes

General Notes

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Architect

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9	DSA ADDENDUM 10	10/02/26

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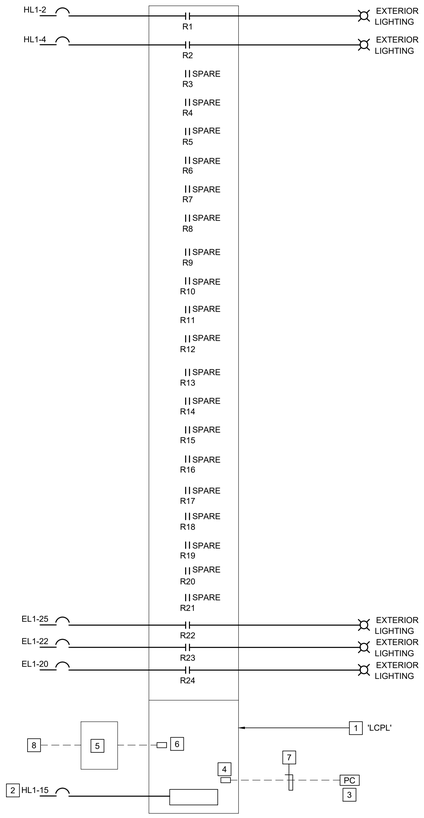
Project Number: 2171
Checked By:

Date: 08/27/24
Reviewed By:

X/E300
AD10

LIGHTING CONTROL PANEL SCHEDULE "LCPL" LOCATED IN BLDG L ELECTRICAL ROOM 120			24 SWITCHING RELAY NEMA 1 ENCLOSURE FLUSH SURFACE X	
RELAY NO.	CIRCUIT NO.	LOAD DESCRIPTION	CONTROL DESCRIPTION	NOTES
R1	HL1-2	BLDG EXTERIOR LIGHTING	PHOTOCELL ON PHOTOCELL/ TIMECLOCK OFF	1
R2	HL1-4	BLDG EXTERIOR LIGHTING	PHOTOCELL ON PHOTOCELL/ TIMECLOCK OFF	1
R3	SPARE			
R4	SPARE			
R5	SPARE			
R6	SPARE			
R7	SPARE			
R8	SPARE			
R9	SPARE			
R10	SPARE			
R11	SPARE			
R12	SPARE			
R13	SPARE			
R14	SPARE			
R15	SPARE			
R16	SPARE			
R17	SPARE			
R18	SPARE			
R19	SPARE			
R20	SPARE			
R21	SPARE			
R22	EL1-25	BLDG EXTERIOR LIGHTING	PHOTOCELL ON PHOTOCELL/ TIMECLOCK OFF	1,2
R23	EL1-22	BLDG EXTERIOR LIGHTING	PHOTOCELL ON PHOTOCELL/ TIMECLOCK OFF	1,2
R24	EL1-20	BLDG EXTERIOR LIGHTING	PHOTOCELL ON PHOTOCELL/ TIMECLOCK OFF	1,2

NOTES:
1. PROGRAM RELAY FOR PHOTOCELL'ON' WITH PROGRAMMED 'OFF' AS DIRECTED BY OWNER.
2. RELAY TO FAIL-SAFE TO CLOSED POSITION UPON LOSS OF OF UTILITY POWER AND TURN LIGHTING FIXTURES CONTROLLED ON. PROVIDE BARRIER IN PANEL AND BARRIER EMERGENCY CIRCUITS FROM NORMAL CIRCUITS WITHIN RELAY PANEL.



1 LIGHTING CONTROL PANEL LCPL DIAGRAM
SCALE: NONE

DSA File No.:
DSA File

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Sheet Reference Notes

1. ACUITY ARP-NLT LIGHTING CONTROL PANEL COMPLETE WITH PHOTOCELL AND AUXILIARY EQUIPMENT SPECIFIED, PROVIDE WITH 'FAIL SAFE/CLOSED RELAYS', REFER TO SPECIFICATIONS.
2. DEDICATED CONTROL CIRCUIT.
3. LOW VOLTAGE EXTERIOR DIGITAL PHOTOCELL ON ROOF.
4. PHOTOCELL INPUT CARD.
5. LINK TO BUILDING EMS AUTOMATION CABINET, MOUNT ABOVE LIGHTING CONTROL PANEL.
6. BACNET INTERFACE CARD FOR EMS SYSTEM CONTROL.
7. (1) 3/4"C WITH CONTROL WIRING AS PER MANUFACTURER.
8. TO EMS SYSTEM CONTROLLER, COORDINATE WITH EMS SYSTEM SUPPLIER.

1. CONTRACTOR TO PROVIDE COMPLETE MANUFACTURERS SHOP DRAWINGS SPECIFIC TO THIS PROJECT FOR THE LIGHTING CONTROL SYSTEM.
2. ALL WIRING FOR THE EMERGENCY SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH CEC 700.9.
3. PROVIDE A BARRIER IN EACH LIGHTING CONTROL PANEL TO SEPARATE THE NORMAL AND EMERGENCY SYSTEM RELAYS AS REQUIRED.
4. VERIFY EACH RELAY PROGRAMMING WITH OWNER AND PROGRAM EACH AS DIRECTED BY OWNER.
5. PROVIDE OWNER IN SERVICE TRAINING FOR LIGHTING CONTROL SYSTEM.

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LICENSED ARCHITECT MARGRET K. FENNO No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA
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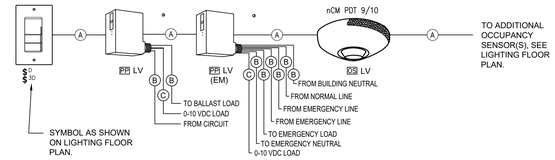
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X/E301
AD10

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LEGEND

- PUSH BUTTON /DIMMER SWITCH SENSOR SWITCH #nPODm2P/4P-DX
- LOW VOLTAGE POWER PACK SENSOR SWITCH #nSP5-D
- LOW VOLTAGE CEILING OCCUPANCY SENSOR (DUAL TECHNOLOGY) SENSOR SWITCH #nCMPDT9
- LOW VOLTAGE POWER PACK WITH SHUNT RELAY SENSOR SWITCH #nSP5Der

WIRE LEGEND

- A — CAT 6 (LOW VOLTAGE)
- B — CLASS 1 (LINE VOLTAGE)
- C — CLASS 2 (LOW VOLTAGE)

9

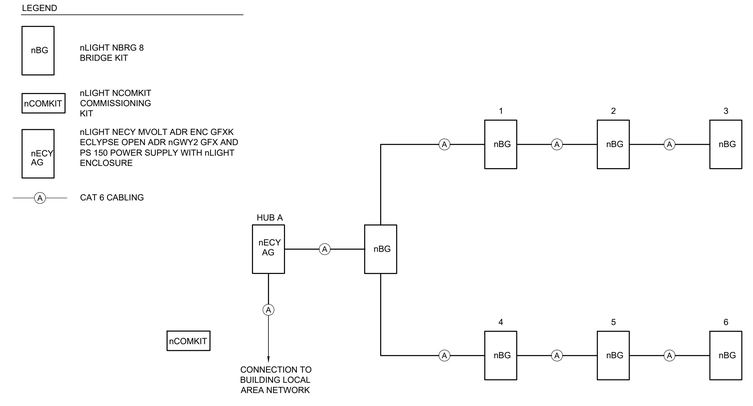
NOTES:

1. FOR CLARITY POWER PACKS ARE NOT SHOWN ON FLOOR PLANS.
2. PART NUMBERS SHOWN ARE BASED ON SENSOR SWITCH AND nLIGHT LIGHTING CONTROL PRODUCTS.

LIGHTING CIRCUIT LEGEND

SYMBOL	DESCRIPTION
	INDICATES FIXTURE ON NORMAL BRANCH CIRCUIT
E	INDICATES FIXTURE BACKED UP WITH EMERGENCY GENERATOR

1 TYPICAL ROOM LIGHTING CONTROL DIAGRAM
SCALE: NONE



2 TYPICAL BUILDING FUNCTIONAL BLOCK BACKBONE DIAGRAM
SCALE: NTS

DSA File No.:
DSA File

DSA Application No.:
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LICENSED ARCHITECT MICHAEL K. FENECO No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

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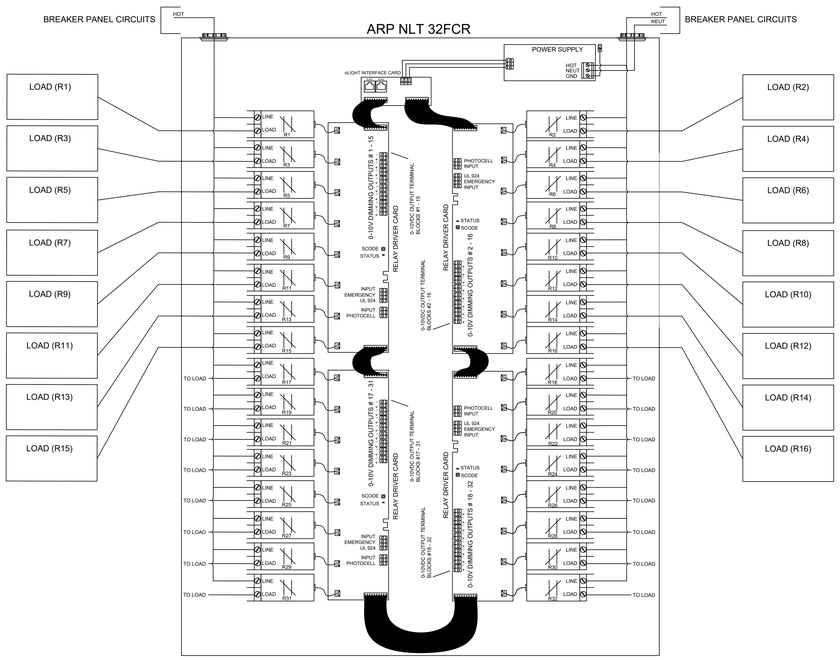
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AD10

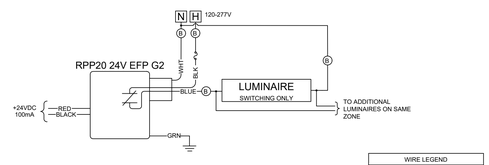
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32 RELAY PANEL SHOWN. FOR 24 RELAY PANEL, R25 - R32 WILL BE PROVIDED AS SPACES.

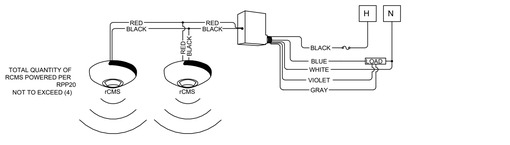
TYPICAL DIAGRAM: ARP NLT 24FCR/32FCR

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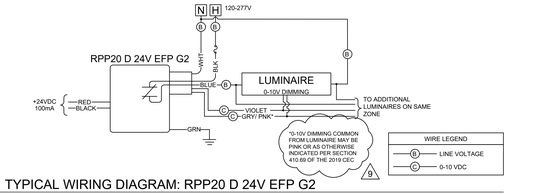
TYPICAL WIRING DIAGRAM: RPP20 24V EFP G2

N.T.S.



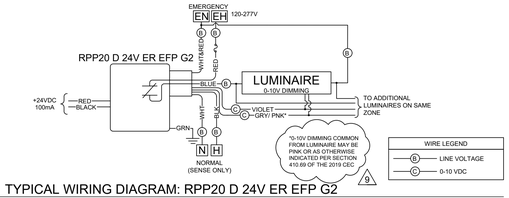
RPP20 D 24V W/ MULTIPLE OCC SENSORS

N.T.S.



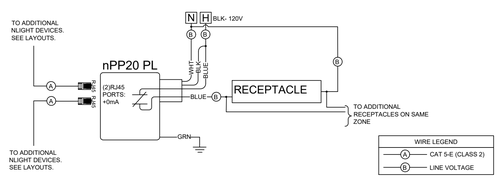
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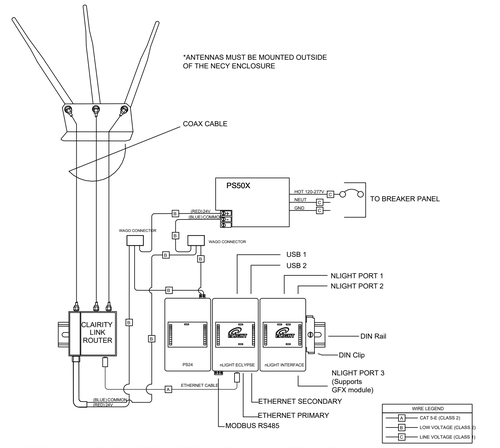
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N.T.S.



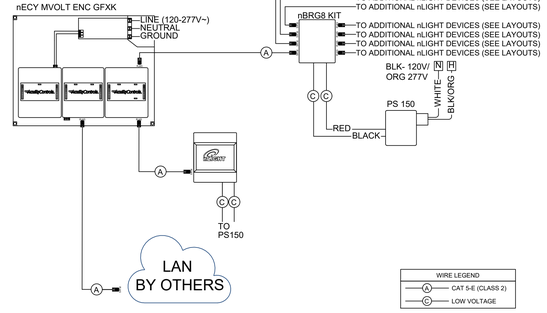
TYPICAL WIRING DIAGRAM: NPP20 PL

N.T.S.



NECY MVOLT ENC REM DETAIL (ENCLOSURE NOT SHOWN)

N.T.S.



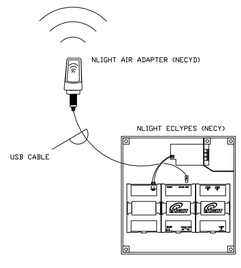
TYPICAL WIRING DIAGRAM: nECY MVOLT ENC GFXK

N.T.S.

NETWORKED DESIGN NOTES:

1. THE RELIABILITY OF ALL WIRELESS SIGNALS ARE HEAVILY DEPENDANT ON DEVICE LOCATION.
2. PHYSICAL OBJECT INTERFERENCE (ESPECIALLY METAL AND LARGE BARRIERS) CAN INHIBIT NLIGHT AIR WIRELESS COMMUNICATION FROM LOCAL DEVICES REACHING THE NLIGHT AIR ADAPTER.
3. FOR OPTIMAL PERFORMANCE INSTALL THE NLIGHT AIR ADAPTER VERTICALLY IN A CENTRAL LOCATION, SUCH AS IN A CORRIDOR OR A SPACE WITH LITTLE OBSTRUCTION BETWEEN THE ADAPTER AND THE RECEIVING DEVICES IN ITS INITIAL BROADCAST RANGE.
4. THE NLIGHT AIR ADAPTER CABLE WILL ALLOW FOR MOUNTING UP TO 15' FROM THE NLIGHT ECLYPSE.
5. IF SITE CONDITIONS PREVENT UNOBSTRUCTED ACCESS, CONTACT LOCAL ACUITY BRANDS REPRESENTATIVE OR TECHNICAL SUPPORT.

LOCAL REP LOCATOR: https://www.acuitybrands.com/support/how-to-buy
ACUITY BRANDS TECH SUPPORT: (800) 535-2465

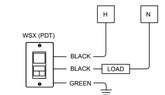


SYSTEM NOTES

1. EACH ZONE OF CONTROL IS LIMITED TO 128 DEVICES.
2. EVERY FLOOR THAT CONTAINS NETWORKED NLIGHT AIR DEVICES REQUIRES ITS OWN DEDICATED NECY WITH NECYD.
3. DEVICES WITHIN INITIAL BROADCAST RANGE SHOULD BE WITHIN 100 FEET (TYPICAL FOR INDOOR CONSTRUCTION) OR WITHIN 1,000 FEET LINE-OF-SIGHT (TYPICAL FOR OUTDOOR CONSTRUCTION).
4. NLIGHT AIR ADAPTER SHOULD BE PLACED IN AN OPEN SPACE FOR BEST WIRELESS SIGNAL STRENGTH.

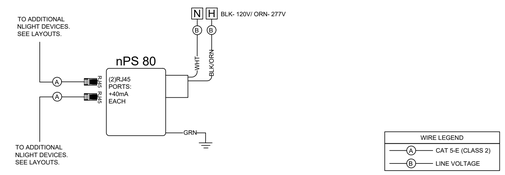
NLIGHT ECLYPSE (NECY) TO NLIGHT AIR ADAPTER (NECYD)

N.T.S.



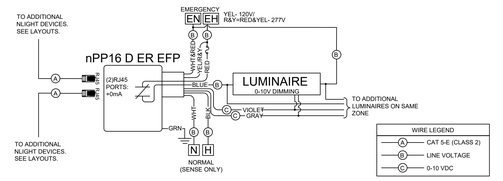
WALL SWITCH, 1 POLE, AUTO ON/OFF

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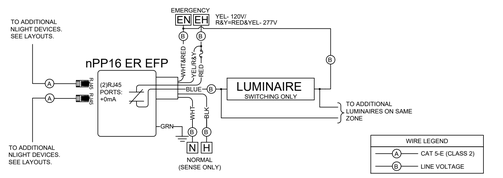
TYPICAL WIRING DIAGRAM: NPS 80

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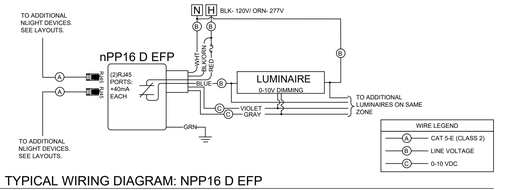
TYPICAL WIRING DIAGRAM: NPP16 D ER EFP

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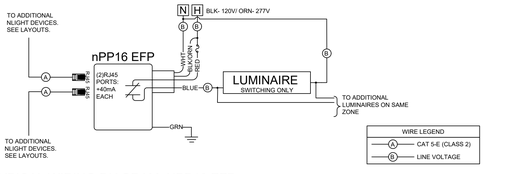
TYPICAL WIRING DIAGRAM: NPP16 ER EFP

N.T.S.



TYPICAL WIRING DIAGRAM: NPP16 D EFP

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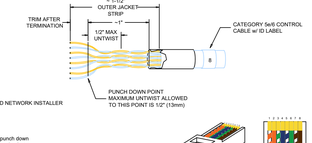


TYPICAL WIRING DIAGRAM: NPP16 EFP

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TIA / EIA-568-B CABLING STANDARD TERMINATION

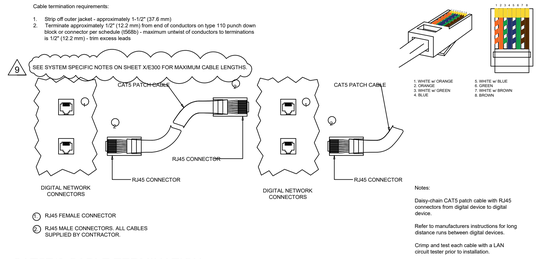
Function	#	PAIR	PIN OUT (T568B)	Wire Color
(T1) (R1)	1	1	5	WHITE w/ BLUE
			4	BLUE
Tx + (T2) Tx - (R2)	2	2	1	WHITE w/ ORANGE
			2	ORANGE
Rx + (T3) Rx - (R3)	3	3	3	WHITE w/ GREEN
			6	GREEN
(T4) (R4)	4	4	7	WHITE w/ BROWN
			8	BROWN



TERMINATION & TESTING OF CAT5 CABLES MUST BE DONE BY A QUALIFIED NETWORK INSTALLER

Cable termination requirements:

1. Strip off outer jacket - approximately 1-1/2" (37.6 mm)
2. Terminate approximately 1/2" (12.2 mm) from end of conductors on type 110 punch down block or connector per schedule (568b) - maximum untwist of conductors to terminations is 1/2" (12.2 mm) - trim excess leads



1 RJ45 FEMALE CONNECTOR
2 RJ45 MALE CONNECTORS. ALL CABLES SUPPLIED BY CONTRACTOR.

Notes:

Daisy-chain CAT5 patch cable with RJ45 connectors from digital device to digital device.

Refer to manufacturers instructions for long distance runs between digital devices.

Crimp and test each cable with a LAN circuit tester prior to installation.

CAT5E/6 CABLE TERMINATION

N.T.S.

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

General Notes

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Project

TYPICAL LIGHTING CONTROL WIRING DIAGRAMS / INSTALLATIONS
Drawing

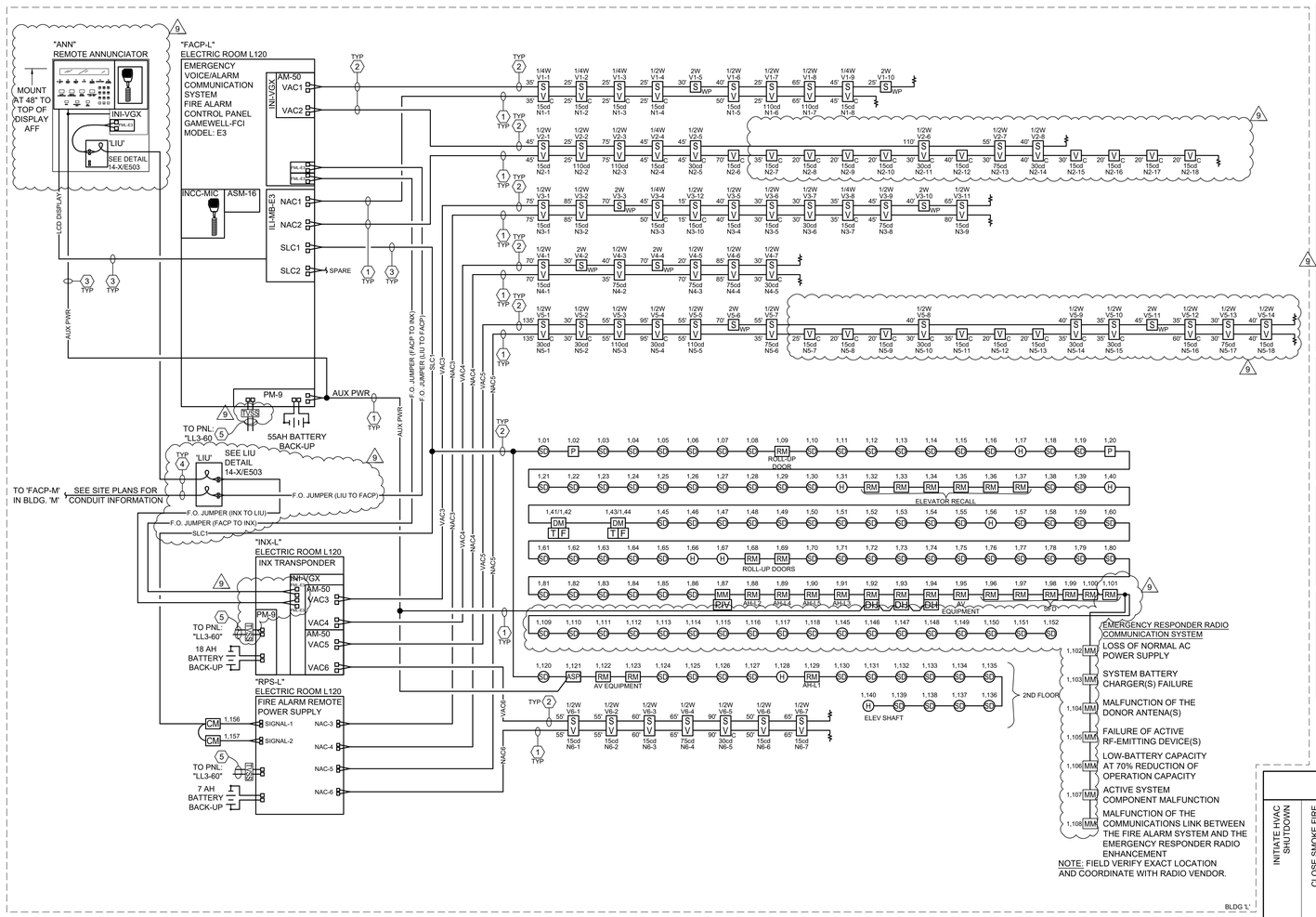
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LICENSED ARCHITECT MICHAEL K. FENNOY No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA
Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

	Designed By:	Copyright 2021 Darden Architects
Scale: As indicated	Drawn By:	
Project Number: 2171	Checked By:	X/E303
Date: 08/27/24	Reviewed By:	AD10



FEEDER SCHEDULE

1. 1" C - (2)#14 UNSHIELDED BELDEN 6120UL (CSFM# 7161-0060:0104) OR CABLING AS PER MANUFACTURERS RECOMMENDATIONS.
2. 1" C -(2)#14 SHIELDED TWISTED PAIR, BELDEN 6100FL (CSFM# 7161-0060:0104) OR CABLING AS PER MANUFACTURERS RECOMMENDATIONS.
3. 1" C - (2)#16 UNSHIELDED TWISTED PAIR, BELDEN 6220UJ (CSFM# 7161-0060:0104) OR CABLING AS PER MANUFACTURERS RECOMMENDATIONS.
4. 1"C - MULTIMODE 6-STRAND FIBER OPTIC, OM1, 62.5UM. (OSP). RED JACKET WITH ST CONNECTORS. LABEL AS FIRE ALARM NETWORK IN EACH PULL BOX. ALL FIBER SHALL BE TERMINATED USING PRE-FABRICATED PIGTAILS, CONTRACTOR SHALL FUSION SPLICE ALL PIGTAILS AND CONNECTORS IN WALL MOUNTED FIBER SPLICE ENCLOSURE. FIELD TERMINATED CONNECTORS ARE NOT ACCEPTABLE. CONTRACTOR SHALL PROVIDE ALL JUMPERS IN SUFFICIENT LENGTH BETWEEN FIBER SPLICE ENCLOSURE AND FIBER OPTIC MODULES IN EQUIPMENT. REFER TO DETAIL 14-X/E503 FOR LIU AND FIBER CABLING LABEL REQUIREMENTS.
5. 120 VAC DEDICATED CIRCUIT. PROVIDE CIRCUIT BREAKER LOCKING DEVICE WITH RED HANDLE AND LABEL "FIRE ALARM CIRCUIT CONTROL". SEE FLOOR PLANS AND PANEL SCHEDULES FOR CIRCUIT DESIGNATION(S).

** CONDUIT SIZE SHOWN IS MINIMUM. UNLESS OTHERWISE NOTED ON PLANS, REFER TO SITE AND FLOOR PLANS FOR ADDITIONAL FIRE ALARM CONDUIT SIZE REQUIREMENTS. EC SHALL SUBMIT CABLE MAKE/MODEL/CSFM LISTING (OR APPROVED EQUAL) WITH FIRE ALARM PROJECT DATA.

SYSTEM DESCRIPTION

INITIATING CIRCUIT CLASS: 'B'

SYSTEM TYPE: AUTOMATIC

INDICATING CIRCUIT CLASS: B STYLE: Y

THE FIRE ALARM SYSTEM SHALL BE OF A TYPE THAT UPON ACTIVATION INITIATES NOTIFICATION BY MEANS OF AND EMERGENCY VOICE/ALARM COMMUNICATION SYSTEM (EVACS).

SIGNAL DEVICE CIRCUITING LEGEND

DEVICE SYMBOL → V
SIGNAL CIRCUIT # (N)NAC (V)VAC — N1 - 1 — DEVICE #

INITIATING DEVICE CIRCUITING LEGEND

P — DEVICE SYMBOL
1,08 — DEVICE ADDRESS NUMBER
SIGNAL LINE CIRCUIT #

COMPLETE AUTOMATIC FIRE ALARM SYSTEM SUBMITTAL

SEQUENCE OF OPERATIONS

FUNCTION / DEVICE	INITIATE HVAC SHUTDOWN	CLOSE SMOKE FIRE DAMPERS	ACTIVATE VISUAL ALARM SIGNAL	ACTIVATE AUDIBLE ALARM SIGNAL	ACTIVATE SUPERVISORY ALARM AT FACP	ANNUNCIATE AT FIRE CONTROL REMOTE ANNUNCIATOR (alarm & trouble)	ANNUNCIATE AT FIRE CONTROL PANEL (alarm & trouble)	ANNUNCIATE AT 24-HOUR ATTENDED REMOTE LOCATION (alarm & trouble)
MANUAL PULL STATIONS	YES	YES	YES	YES	YES	YES	YES	YES
AREA SMOKE & HEAT DETECTOR	YES	YES	YES	YES	YES	YES	YES	YES
BEAM SMOKE DETECTOR	YES	YES	YES	YES	YES	YES	YES	YES
FIRE SPRINKLER FLOW SWITCH	YES	YES	YES	YES	YES	YES	YES	YES
FIRE SPRINKLER TAMPER SWITCH	NO	NO	NO	NO	YES	YES	YES	YES
P.I.V. TAMPER SWITCH	NO	NO	NO	NO	YES	YES	YES	YES
DDCV TAMPER SWITCH	NO	NO	NO	NO	NO	YES	YES	YES
BUILDING POWER FAILURE	NO	NO	NO	NO	NO	YES	YES	YES
EARTH GROUND FAULT	NO	NO	NO	NO	NO	YES	YES	YES

FIRE ALARM SYMBOLS LEGEND:

SYMBOL	MODEL #	CSFM #
FACP	EMERGENCY VOICE/ALARM COMMUNICATION SYSTEM(EV/ACS) FIRE ALARM CONTROL PANEL GAMEWELL-FCI: MODEL E3 WITH: INTELEGENT LOOP INTERFACE MASTER BOARD: ILI-MB-E3 LCD KEYPAD DISPLAY: LCD-E3 ADDRESSABLE SWITCH MODULE: ASM-16 MICROPHONE: INCC-MIC TRANSPONDER VOICE GATEWAY: INI-VGX AMPLIFIER: AM-50 NETWORK REPEATER: RPT-E3 POWER SUPPLY MODULE: PM-9 FIBER LOOP MODULE FML-E3	7165-1703:0125 7165-1703:0176
ANN	REMOTE ANNUNCIATOR PANEL: GAMEWELL-FCI: LCD-E3-DISPLAY GAMEWELL-FCI: INI-VGX GAMEWELL-FCI: INCC-MIC GAMEWELL-FCI: CABINET 'B' SIZE	7165-1703:0125
RPS-1	REMOTE POWER SUPPLY: GAMEWELL-FCI: HPF-PS6	7315-1637:0505
INX-1	INTELLIGENT NETWORK TRANSPONDER GAMEWELL-FCI: -INI-VGX -FML-E3 -AM-50 -PM-9	7165-1703:0125
SD	PHOTO SMOKE DETECTOR GAMEWELL-FCI: ASD-PL3 BASE- GAMEWELL-FCI: B300-6	7272-1703:0501 7300-1653:0109
H	HEAT DETECTOR GAMEWELL-FCI: ATD-L3 BASE- GAMEWELL-FCI: B300-6	7270-1703:0502 7300-1653:0109
BDT BDR	BEAM SMOKE DETECTOR TRANSMITTER AND REFLECTOR GAMEWELL-FCI: ABD-RT2F WITH RTS-151 TEST STATION	7260-1703:0120 7300-1653:0212
ASP	ASPIRATION DETECTOR VESDA: VEP-A00-1P-GW	7259-1728:0503
P	MANUAL PULL STATION GAMEWELL-FCI: MS-7AF	7150-1703:0119
RM	RELAY CONTROL MODULE GAMEWELL-FCI: AOM-2RF	7300-1703:0102
CM	CONTROL MODULE GAMEWELL-FCI: AOM-2SF	7300-1703:0102
MM	MONITOR MODULE GAMEWELL-FCI: AMM-2F	7300-1703:0102
DM	DUAL MONITOR MODULE GAMEWELL-FCI: AMM-2IF	7300-1703:0107
DH	MAGNETIC DOOR HOLDER GAMEWELL-FCI: DH	3550-1039:0100
S WP	SPEAKER (WEATHER PROOF)* WHEELOCK: ET1010-W (2W EXTERIOR)	7320-0785:0105
S	SPEAKER - INTERIOR* WHEELOCK:ELSPKW-AL (.5W EXTERIOR)	7320-0785:0505
S C	SPEAKER - CEILING*-INTERIOR* WHEELOCK:ELSPKWC-AL (.5W EXTERIOR)	7320-0785:0505
SV (**cd) (***W)	SPEAKER/STROBES-WALL* WHEELOCK: ELSPSTW-AL (**SIZES AS PER PLANS) (.5W INTERIOR)	7320-0785:0505
SV C (**cd) (***W)	SPEAKER/STROBES-CEILING* WHEELOCK: ELSPSTWC-AL (**SIZES AS PER PLANS) (.5W INTERIOR)	7320-0785:0505
V (**cd) (***W)	VISUAL-WALL* WHEELOCK: ELSTW-AL (**SIZES AS PER PLANS)	7135-0785:0504
V C (**cd) (***W)	VISUAL-CEILING* WHEELOCK: ELSTWC-AL (**SIZES AS PER PLANS)	7135-0785:0504
DSM	DUAL SYNC MODULE WHEELOCK: DSM-12/24-4	7300-0785-0132
T	FIRE SPRINKLER RISER TAMPER SWITCH (BY OTHERS)	–
F	FIRE SPRINKLER RISER FLOW SWITCH (BY OTHERS)	–
PIV	POST INDICATOR VALVE (BY OTHERS)	–
DDCV	FIRE SPRINKLER DOUBLE DETECTOR CHECK VALVE (BY OTHERS)	–
SFD	SMOKE FIRE DAMPER (BY OTHERS)	–
TVSS	SURGE PROTECTOR SPACE AGE: E120V-GT	4945-0553:0501
	END OF LINE RESISTER (EOLR)	–

* ENSURE NOTIFICATION DEVICES IS NOT PROVIDED WITH ANY "FIRE" MARKING OR IMPRINT ON THE DEVICE SINCE THIS DEVICE IS USED FOR BOTH FIRE NOTIFICATION AND CARBON MONOXIDE NOTIFICATION.

** DEVICE HAS MULTIPLE CANDELA RATINGS. THE E.C. IS RESPONSIBLE FOR CORRECTLY SETTING EACH STROBE OR SPEAKER/STROBE DEVICE ACCORDING TO THESE FIRE ALARM DRAWINGS.

*** DEVICE HAS MULTIPLE WATTAGE SETTINGS. THE E.C. IS RESPONSIBLE FOR CORRECTLY SETTING EACH SPEAKER OR SPEAKER/STROBE DEVICE ACCORDING TO THESE FIRE ALARM DRAWINGS.

GL-2 FIRE ALARM NOTES CHECKLIST:

1. APPLICABLE STANDARD NFPA 72, AS ADOPTED AND AMENDED IN CBC CHAPTER 35
2. INSTALLATION OF THE SYSTEMS SHALL NOT BE STARTED UNTIL DETAILED DESIGN DOCUMENTS AND SPECIFICATION, INCLUDING STATE FIRE MARSHAL LISTING NUMBERS FOR EACH COMPONENT OF THE SYSTEM, HAS BEEN APPROVED BY DSA.
3. UPON COMPLETION OF SYSTEM INSTALLATION, A SATISFACTORY TEST OF THE ENTIRE SYSTEM SHALL BE MADE IN THE PRESENCE OF A DSA PROJECT INSPECTOR.
4. A STAMPED SET OF APPROVED FIRE ALARM DESIGN DOCUMENTS SHALL BE ON THE JOB SITE AND USED FOR INSTALLATION.
5. ANY DISCREPANCIES BETWEEN THE DRAWINGS AND THE CODE OR RECOGNIZED STANDARDS SHALL BE BROUGHT TO THE ATTENTION OF DSA AND THE ARCHITECT/ENGINEER OF THE PROJECT.
6. DSA, ARCHITECT/ENGINEER AND OWNER SHALL BE NOTIFIED A MINIMUM OF 48 HOURS PRIOR TO THE FINAL INSPECTION AND /OR TESTING.
7. ALL PENETRATIONS THROUGH RATED ASSEMBLIES REQUIRING OPENING PROTECTION SHALL BE PROVIDED WITH A PENETRATION FIRE STOP SYSTEM AS IDENTIFIED IN CBC CHAPTER 7, UL OR OTHER APPROVED LAB TESTING CRITERIA. APPROVED TYPES OF MATERIALS SHALL BE IDENTIFIED WITHIN THE PROJECT SPECIFICATIONS WITHIN THE FIRE ALARM SECTION.
8. WALL MOUNTED VISIBLE NOTIFICATION DEVICES SHALL HAVE THEIR BOTTOMS MOUNTED AT 80" MINIMUM AND 96" MAXIMUM FROM FINISHED FLOOR.
9. WALL MOUNTED AUDIBLE NOTIFICATION DEVICES SHALL HAVE THEIR TOPS MOUNTED AT 90" MINIMUM AND 100" MAXIMUM FROM FINISHED FLOOR AND NO CLOSER THAN 6" TO A HORIZONTAL STRUCTURE.
10. AUDIBLE DEVICES SHALL PROVIDE A SOUND PRESSURE LEVEL OF 15 DECIBELS (DBA) ABOVE THE AVERAGE AMBIENT SOUND LEVEL OR FIVE DBA ABOVE THE MAXIMUM SOUND LEVEL HAVING A DURATION OF AT LEAST 60 SECONDS, WHICHEVER IS GREATER, IN EVERY OCCUPIABLE SPACE WITHIN THE BUILDING.
11. AUDIBLE DEVICES SHALL BE SYNCHRONIZED TEMPORAL CODE 3 PATTERN.

    2.16 APPLICABLE CODES: ENSURE THE CURRENT CODES ARE LISTED ON THE PLANS.
12. THE CONTRACTOR SHALL ADJUST/INSTALL ALL DEVICES TO MAXIMIZE PERFORMANCE AND TO MINIMIZE FALSE ALARMS.
13. VISIBLE DEVICES SHOULD NOT EXCEED TWO FLASHES PER SECOND AND SHOULD NOT BE SLOWER THAN ONE FLASH EVERY SECOND. THE DEVICE SHALL HAVE A PULSING LIGHT SOURCE NOT LESS THAN 15 CANDELLA. VISIBLE DEVICES WITHIN 55' FROM EACH OTHER SHALL BE SYNCHRONIZED.
14. UNDERGROUND AND EXTERIOR CONDUITS TO HAVE WATER TIGHT FITTINGS AND WIRE TO BE APPROVED FOR WET LOCATIONS.
15. ALL FIRE ALARM WIRING SHALL BE FPL OR FPLP (FIRE POWER LIMITED OR FIRE POWER LIMITED PLENUM) AS REQUIRED FOR APPLICATION. WIRING IN CONDUIT ABOVE GROUND MAY BE TYPE THHN OR THWN.
16. PER CEC STANDARDS, ALL WIRING IS TO BE PULLED THROUGH EACH JUNCTION BOX AND CONNECTED DIRECTLY TO EACH FIRE DEVICE. DO NOT SPLICE THE WIRE. ALL BOXES TO BE SIZED PER CEC.
17. SMOKE DETECTORS SHALL NOT BE ANY CLOSER THAN 1' FROM FIRE SPRINKLERS OR 3' FROM ANY SUPPLY DIFFUSER. IN AREA OF CONSTRUCTION OR POSSIBLE DAMAGE/CONTAMINATION ON NEWLY INSTALLED FIRE ALARM, DEVICES SHALL BE COVERED UNTIL THAT AREA IS READY TO BE TURNED OVER TO THE OWNER.
18. ALL FIRE ALARM CIRCUITS SHALL BE IN CONDUIT, SURFACE RACEWAY OR OPEN RUN ABOVE CEILINGS, UNDER FLOORS AND IN WALLS IN A NEAT AND PROTECTED MANOR AS INDICATED ON DESIGN DOCUMENTS. EXPOSED CIRCUITS ARE ONLY PERMITTED WHEN NOTED AS EXPOSED ON DESIGN DOCUMENTS.
19. FIRE ALARM PANEL, REMOTES, AND COMPONENTS SHALL BE SECURED TO MOUNTING SURFACES PER MANUFACTURERS SPECIFICATIONS. NO SINGLE DEVICE SHALL EXCEED 20 LBS. WITHOUT SPECIAL MOUNTING DETAILS.
20. A DEDICATED BRANCH CIRCUIT SHALL BE PROVIDED FOR FIRE ALARM EQUIPMENT. THIS CIRCUIT SHALL BE ENERGIZED FROM THE COMMON USE AREA PANEL AND SHALL HAVE NO OTHER OUTLETS. THE BREAKER SHALL HAVE A RED LOCKING DEVICE TO BLOCK THE HANDLE IN THE "ON" POSITION. THE CIRCUIT BREAKER SHALL BE LABELED "FIRE ALARM CIRCUIT CONTROL." CIRCUIT ID TO BE LABELED AT FIRE PANEL/EXTENDERS.
21. THE INSTALLING CONTRACTOR SHALL PROVIDE A COMPLETED "SYSTEM RECORD OF COMPLETION" PER NFPA 72, FIGURE 17.8.2.
22. FIRE ALARM CONTROL PANELS AND REMOTE ANNUNCIATORS SHALL BE INSTALLED WITH THEIR BOTTOMS MOUNTED AT 48" ABOVE THE FINISHED FLOOR.
23. MICROPHONES ASSOCIATED WITH EMERGENCY VOICE ALARM COMMUNICATION SYSTEMS (EVAC) SHALL BE ACCESSIBLE FOR USE, INSTALLED IN COMPLIANCE WITH CBC SECTIONS 11B-305 AND 11B-308.
24. THE INSTALLING CONTRACTOR SHALL PROVIDE SYSTEM PROGRAMMING FOR SUPERVISORY MONITORING PER CBC SECTION 901.6.2.
25. SUPERVISORY MONITORING SHALL BE TESTED AND VERIFIED AS SENDING CORRECT SIGNALS IN CONJUNCTION WITH FINAL ACCEPTANCE TEST.
26. OWNER SHALL BE RESPONSIBLE FOR ESTABLISHING A FIRE SYSTEM MONITORING CONTRACT OR PROVISIONS.

FIRE ALARM RISER DIAGRAM - BUILDING 'L'

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

1. 120 VAC WIRING WILL BE MINIMUM #12 AWG.
2. ALL FIRE ALARM WIRING SHALL BE INSTALLED IN A CONDUIT OR RACEWAY SYSTEM U.O.N.
3. WIRING SHALL NOT BE LOOPED THROUGH DEVICE; WIRE MUST BE CUT FOR IN AND OUT.
4. ALL DEVICES POLARITY MUST BE OBSERVED.
5. FIRE ALARM CONDUIT AND WIRING INSTALLATION SHALL COMPLY WITH CALIFORNIA ELECTRICAL CODE #760.
6. THIS IS A COMPLETE FIRE ALARM SUBMITTAL; If an alternate system is proposed, Contractor shall submit a separate set of engineered plans, specifications, and engineering calcs. for prior approval to the Owner, Division of State Architect (DSA), Architect, and Engineer including but not necessarily limited to:
   a. All CSFM listing numbers and Manufacturers model numbers for all system components proposed for this system.
   b. Complete Riser Diagram with point to point wiring diagrams including battery and voltage drop calculations for the entire system.
   c. Indication of conductor type(s), power-limited or non-power limited system.
   d. Information as required to demonstrate compliance with all applicable code(s) and to obtain approval of all Authority(ies) having Jurisdiction (AHJ). In the event of a substitution, installation shall not begin until separate approval has been obtained and all of the above has been accepted and signed by the (AHJ) and the Architect, see Specification Section 28 3100 regarding substitutions. If routing differs significantly from these plans, approval of the Engineer must be obtained before installation. After construction, provide an accurate set of field record drawings to Owner.
7. FIRE ALARM SYSTEM SHALL BE SURVIVABILITY LEVEL-0.
8. CONTRACTOR SHALL REVIEW ARCHITECTURAL, MECHANICAL, PLUMBING, CIVIL, THEATRICAL LIGHTING, FIRE PROTECTION, FOOD SERVICE AND ALL OTHER PROJECT DRAWINGS AND SPECIFICATIONS, CONFIRM ALL REQUIRED FIRE ALARM CONNECTION AND INCLUDE WITH BID.

VOICE NOTIFICATION MESSAGE

EV/ACS SHALL HAVE THE FOLLOWING PROGRAMMED MESSAGES IN BOTH ENGLISH AND SPANISH:

-(MESSAGE TONE)"THIS IS A TEST OF THE EMERGENCY AUDIO SYSTEM."(PROVIDE A 2 SECOND PAUSE)(REPEAT THE MESSAGE.)

-(TEMPORAL 3 TONE FOLLOWED BY) "MAY I HAVE YOUR ATTENTION PLEASE! MAY I HAVE YOUR ATTENTION PLEASE! THE SIGNAL YOU JUST HEARD INDICATED A REPORT OF AN EMERGENCY IN THIS BUILDING. PLEASE PROCEED TO THE NEAREST EXIT AND LEAVE THE BUILDING. DO NOT RE-ENTER THE BUILDING UNLESS DIRECTED TO DO SO BY THE PROPER AUTHORITIES." (PROVIDE A 2 SECOND PAUSE.)(REPEAT THE MESSAGE.)

-(MESSAGE TONE)"YOUR ATTENTION PLEASE. THE BUILDING EMERGENCY CONDITION HAS BEEN CLEARED. YOU MAY RETURN TO YOUR NORMAL ACTIVITY. THE BUILDING EMERGENCY CONDITION HAS BEEN CLEARED. YOU MAY RETURN TO YOUR NORMAL ACTIVITY.(PROVIDE A 2 SECOND PAUSE.)(REPEAT THE MESSAGE TWICE.)

FIRE ALARM SYSTEM NOTES

- FIRE ALARM SYSTEM SHALL BE SUPERVISED BY AN APPROVED, UL LISTED CENTRAL STATION (UUFX) OR REMOTE STATION (UUJS) MONITORING COMPANY. (REF: CFC, 907.2.3.5)
- DOCUMENTATION CABINET TO BE INSTALLED PROXIMAL TO THE FACU. (NFPA 72, 7.7.2.1)
- ALL RECORD DOCUMENTATION SHALL BE STORED IN THE DOCUMENTAION CABINET. (NFPA 72, 7.7.2.2)
- THE DOCUMENTATION CABINET TO BE PROMINENTLY LABELED "SYSTEM RECORD DOCUMENTS". (NFPA 72, 7.7.2.4)
- PROVIDE ALL REQUIRED LABELING FOR FIRE ALARM EQUIPMENT PER CFC 509.
- ALL FIRE ALARM DEVICES SHALL BE WHITE IN COLOR (WHERE WHITE COLOR IS A DEVICE OPTION)

General Notes

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Project

FIRE ALARM RISER DIAGRAM
- BUILDING 'L'
Drawing

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LICENSED ARCHITECT RODNEY K. FENG No. C23724 REG. 4-30-27 STATE OF CALIFORNIA
Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

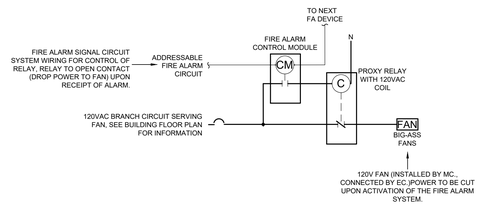
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Checked By:
Reviewed By:

Scale: As indicated
Project Number: 2171
Date: 08/27/24

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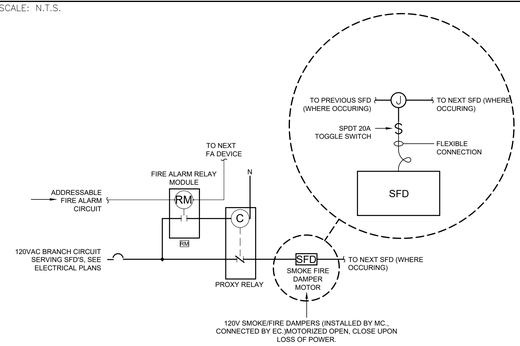
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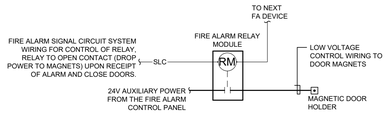
10 CONTROL MODULE WIRING DIAGRAM AT PADDLE FAN IN BLDG-M

SCALE: N.T.S.



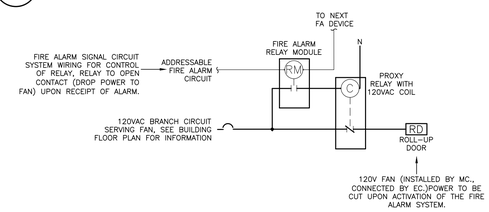
11 TYPICAL SFD BRANCH CIRCUIT/ RELAY MODULE WIRING DIAGRAM

SCALE: NTS



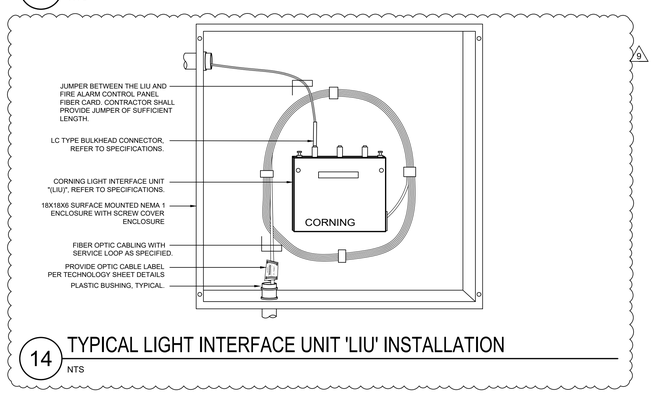
12 RELAY MODULE / CONTROL WIRING DIAGRAM AT DOOR HOLD OPEN EQUIPMENT BLDG-L

NTS



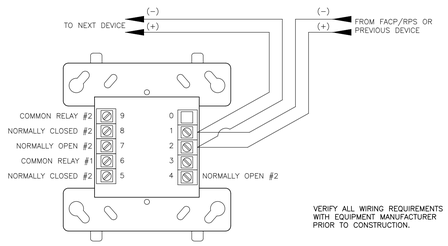
13 RELAY MODULE / CONTROL WIRING DIAGRAM AT ROLL-UP DOORS

NTS



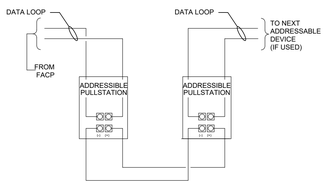
14 TYPICAL LIGHT INTERFACE UNIT 'LIU' INSTALLATION

NTS



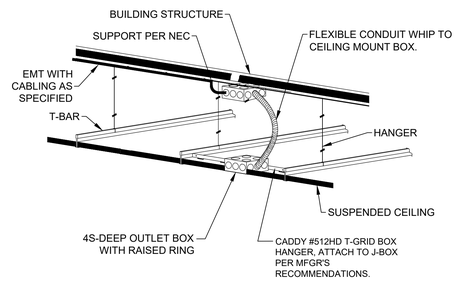
6 TYPICAL ADDRESSABLE CONTROL MODULE WIRING DIAGRAM

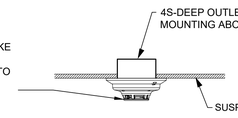
NTS



7 TYPICAL ADDRESSABLE PULL STATION - WIRING DIAGRAM

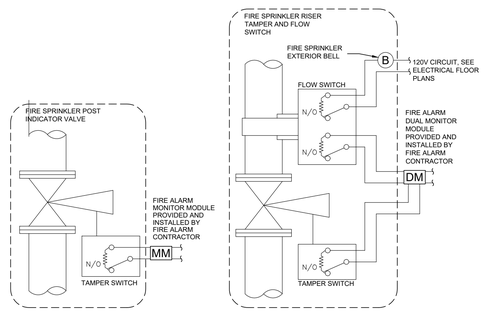
NTS





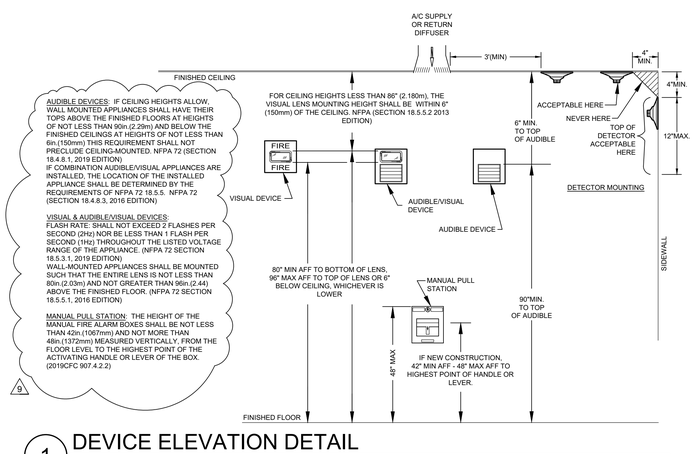
8 TYPICAL SMOKE DETECTOR MOUNTING DETAIL

NTS



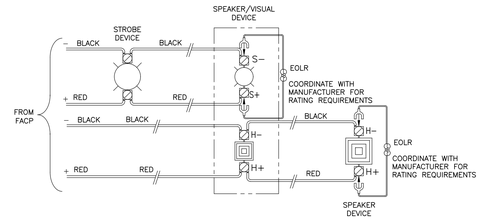
9 FIRE SPRINKLER RISER & POST INDICATOR VALVE(PIV) WIRING DIAGRAM

NTS



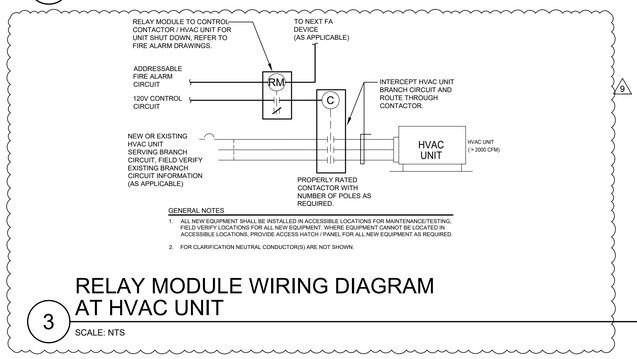
1 DEVICE ELEVATION DETAIL

NTS



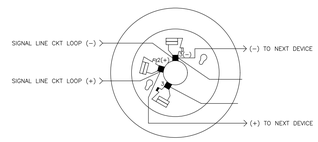
2 TYPICAL NOTIFICATION CIRCUIT WIRING DIAGRAM

NTS



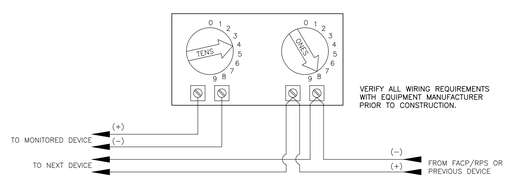
3 RELAY MODULE WIRING DIAGRAM AT HVAC UNIT

SCALE: NTS



4 ADDRESSABLE SMOKE AND HEAT DETECTOR WIRING DIAGRAM

NTS



5 TYPICAL ADDRESSABLE MONITOR MODULE WIRING DIAGRAM

NTS

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

1. 120 VAC WIRING WILL BE MINIMUM #12 AWG.
2. ALL FIRE ALARM WIRING SHALL BE INSTALLED IN A CONDUIT OR RACEWAY SYSTEM U.O.N.
3. WIRING SHALL NOT BE LOOPED THROUGH DEVICE; WIRE MUST BE CUT FOR IN AND OUT.
4. ALL DEVICES POLARITY MUST BE OBSERVED.
5. FIRE ALARM CONDUIT AND WIRING INSTALLATION SHALL COMPLY WITH CALIFORNIA ELECTRICAL CODE #760.
6. THIS IS A COMPLETE FIRE ALARM SUBMITTAL; If an alternate system is proposed, Contractor shall submit a separate set of engineered plans, specifications, and engineering calcs. for prior approval to the Owner, Division of State Architect (DSA), Architect, and Engineer including but not necessalriy limited to:
   a. All CSFM listing numbers and Manufacturers model numbers for all system components proposed for this system.
   b. Complete Riser Diagram with point to point wiring diagrams including battery and voltage drop calculations for the entire system.
   c. Indication of conductor type(s), power-limited or non-power limited system.
   d. Information as required to demonstrate compliance with all applicable code(s) and to obtain approval of all Authority(ies) having Jurisdiction (AHJ). In the event of a substitution, installation shall not begin until separate approval has been obtained and all of the above has been accepted and signed by the (AHJ) and the Architect, see Specification Section 01631 regarding substitutions. If routing differs significantly from these plans, approval of the Engineer must be obtained before installation. After construction, provide an accurate set of field record drawings to Owner.
7. FIRE ALARM SYSTEM SHALL BE SURVIVABILITY LEVEL-0.
8. CONTRACTOR SHALL REVIEW ARCHITECTURAL, MECHANICAL, PLUMBING, CIVIL, THEATRICAL LIGHTING, FIRE PROTECTION, FOOD SERVICE AND ALL OTHER PROJECT DRAWINGS AND SPECIFICATIONS, CONFIRM ALL REQUIRED FIRE ALARM CONNECTION AND INCLUDE WITH BID.

VOICE NOTIFICATION MESSAGE

EV/ACS SHALL HAVE THE FOLLOWING PROGRAMMED MESSAGES IN BOTH ENGLISH AND SPANISH:

-(MESSAGE TONE)"THIS IS A TEST OF THE EMERGENCY AUDIO SYSTEM."(PROVIDE A 2 SECOND PAUSE)(REPEAT THE MESSAGE.)

-(TEMPORAL 3 TONE FOLLOWED BY) "MAY I HAVE YOUR ATTENTION PLEASE! MAY I HAVE YOUR ATTENTION PLEASE! THE SIGNAL YOU JUST HEARD INDICATED A REPORT OF AN EMERGENCY IN THIS BUILDING. PLEASE PROCEED TO THE NEAREST EXIT AND LEAVE THE BUILDING. DO NOT RE-ENTER THE BUILDING UNLESS DIRECTED TO DO SO BY THE PROPER AUTHORITIES." (PROVIDE A 2 SECOND PAUSE.)(REPEAT THE MESSAGE.)

-(MESSAGE TONE)"YOUR ATTENTION PLEASE. THE BUILDING EMERGENCY CONDITION HAS BEEN CLEARED. YOU MAY RETURN TO YOUR NORMAL ACTIVITY. THE BUILDING EMERGENCY CONDITION HAS BEEN CLEARED. YOU MAY RETURN TO YOUR NORMAL ACTIVITY.(PROVIDE A 2 SECOND PAUSE.)(REPEAT THE MESSAGE TWICE.)

FIRE ALARM SYSTEM NOTES

- FIRE ALARM SYSTEM SHALL BE SUPERVISED BY AN APPROVED, UL LISTED CENTRAL STATION (UUFX) OR REMOTE STATION (UUJS) MONITORING COMPANY. (REF: CFC, 907.2.3.5)
- DOCUMENTATION CABINET TO BE INSTALLED PROXIMAL TO THE FACU. (NFPA 72, 7.7.2.1)
- ALL RECORD DOCUMENTATION SHALL BE STORED IN THE DOCUMENTAION CABINET. (NFPA 72, 7.7.2.2)
- THE DOCUMENTATION CABINET TO BE PROMINENTLY LABELED "SYSTEM RECORD DOCUMENTS". (NFPA 72, 7.7.2.4)
- PROVIDE ALL REQUIRED LABELING FOR FIRE ALARM EQUIPMENT PER CFC 509.
- ALL FIRE ALARM DEVICES SHALL BE WHITE IN COLOR (WHERE WHITE COLOR IS A DEVICE OPTION)

General Notes

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THOMA ELECTRIC, INC.
P.O. Box 1167 - 3562 Empleo St.
San Luis Obispo, CA 93406
Phone: (805) 543-3850
Fax: (805) 543-3829
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PROFESSIONAL ENGINEER WILLIAM A. THOMA ELECTRICAL STATE OF CALIFORNIA
EXPIRES: 06/30/25
Consultant THOMA #22-8060

SANGER EDUCATION COMPLEX-PHASE 3
Sanger Unified School District
1760 S Fowler Ave, Fresno CA 93727
Project

9 *FIRE ALARM DETAILS*
Drawing

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LICENSED ARCHITECT RICHARD K. FERNOD No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA
Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

Designed By:
Drawn By:
Checked By:
Reviewed By:

Scale: As indicated
Project Number: 2171
Date: 08/27/24

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X/E503
AD10

K:\ENG\2022\22-8060\22-8060_XE500-XE503_FA RISER DIAGRAM.dwg - Roger - Oct 01, 2026 - 7:29am

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
VAC/VOICE SIG CKT#: V3

CKT/DEVICE #	V3-1	V3-2	V3-3	V3-4	V3-5	V3-6	V3-7	V3-8	V3-9	V3-10
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	75	85	70	45	40	30	35	45	40	
AMPS @ DEVICE	0.0208	0.0208	0.083	0.0208	0.0104	0.0208	0.0208	0.0104	0.0208	0.083
AMPS DEVELOPED	0.3532	0.3324	0.3116	0.2286	0.2078	0.1974	0.1766	0.1558	0.1454	0.1246
VOLT. DROP	0.134	0.142	0.110	0.052	0.042	0.030	0.027	0.027	0.033	0.025

CKT/DEVICE #	V3-11	V3-12	V3-13	V3-14	V3-15	V3-16	V3-17	V3-18	V3-19	V3-20
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	65	15	0	0	0	0	0	0	0	0
AMPS @ DEVICE	0.0208	0.0208	0	0	0	0	0	0	0	0
AMPS DEVELOPED	0.0416	0.0208	0	0	0	0	0	0	0	0
VOLT. DROP	0.014	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	V3
TOTAL CKT AMPS.=	0.3532 (8.48W)
CIRCUIT LENGTH =	575FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.637
VOLTAGE AT FINAL DEVICE=	19.763
% VOLTAGE DROP=	3.122

SPEAKER LOAD

INTERIOR	.25W =	.0104A
INTERIOR	.5W =	.0208A
EXTERIOR	2W =	.0830A

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
NAC/VISUAL SIG CKT#: N5

CKT/DEVICE #	N5-1	N5-2	N5-3	N5-4	N5-5	N5-6	N5-7	N5-8	N5-9	N5-10
DEVICE	S/V30cd-C	S/V30cd-C	S/V110cd	S/V30cd-C	S/V110cd	S/V75cd	V15cd-C	V15cd-C	V15cd-C	S/V30cd-C
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	135	30	55	95	55	35	25	20	20	30
AMPS @ DEVICE	0.03	0.03	0.086	0.03	0.086	0.06	0.022	0.022	0.022	0.03
AMPS DEVELOPED	0.648	0.618	0.588	0.502	0.472	0.386	0.326	0.304	0.282	0.26
VOLT. DROP	0.441	0.093	0.163	0.240	0.131	0.068	0.041	0.031	0.028	0.039

CKT/DEVICE #	N5-11	N5-12	N5-13	N5-14	N5-15	N5-16	N5-17	N5-18	N5-19	N5-20
DEVICE	V15cd-C	V15cd-C	V15cd-C	S/V30cd-C	S/V30cd-C	S/V15cd	S/V75cd	S/V15cd	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	35	20	20	35	35	60	30	40	0	0
AMPS @ DEVICE	0.022	0.022	0.022	0.03	0.03	0.022	0.06	0.022	0	0
AMPS DEVELOPED	0.23	0.208	0.186	0.164	0.134	0.104	0.082	0.022	0	0
VOLT. DROP	0.041	0.021	0.019	0.029	0.024	0.031	0.012	0.004	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	N5
TOTAL CKT AMPS.=	0.648
CIRCUIT LENGTH =	775FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	1.457
VOLTAGE AT FINAL DEVICE=	18.943
% VOLTAGE DROP=	7.143

DEVICE LEGEND

SPEAKER/VISUAL	=S/V
VISUAL DEVICE	=V
CANDELA RATING	=XXcd
CEILING	=C
WALL	=(BLANK)

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
NAC/VISUAL SIG CKT#: N1

CKT/DEVICE #	N1-1	N1-2	N1-3	N1-4	N1-5	N1-6	N1-7	N1-8	N1-9	N1-10
DEVICE	S/V15cd-C	S/V15cd-C	S/V15cd-C	S/V15cd-C	S/V15cd	S/V110cd	S/V110cd	S/V15cd-C	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	35	25	25	25	50	25	65	45	0	0
AMPS @ DEVICE	0.022	0.022	0.022	0.022	0.022	0.022	0.086	0.022	0	0
AMPS DEVELOPED	0.304	0.282	0.26	0.238	0.216	0.194	0.108	0.022	0	0
VOLT. DROP	0.054	0.036	0.033	0.030	0.054	0.024	0.035	0.005	0.000	0.000

CKT/DEVICE #	N1-11	N1-12	N1-13	N1-14	N1-15	N1-16	N1-17	N1-18	N1-19	N1-20
DEVICE	0	0	0	0	0	0	0	0	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	0	0	0	0	0	0	0	0	0	0
AMPS @ DEVICE	0	0	0	0	0	0	0	0	0	0
AMPS DEVELOPED	0	0	0	0	0	0	0	0	0	0
VOLT. DROP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	N1
TOTAL CKT AMPS.=	0.304
CIRCUIT LENGTH =	295FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.271
VOLTAGE AT FINAL DEVICE=	20.129
% VOLTAGE DROP=	1.329

DEVICE LEGEND

SPEAKER/VISUAL	=S/V
VISUAL DEVICE	=V
CANDELA RATING	=XXcd
CEILING	=C
WALL	=(BLANK)

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

BATTERY CALCULATIONS

PROJECT: SEC H.S. Ph3 BldgL - FACP-L
Based on 24 Hour Standby

Device	Manufacturer	#	QTY	Standby Amps	Total Standby Amps	Alarm Amps	Total Alarm Amps
Fire Alarm Control Pnl. -EV/ACS	Gamewell-FCI	E3-Series	--	--	0.0000	--	0.0000
Intelegent Loop Interface Master Board	Gamewell-FCI	ILI-MB-E3	1	0.08100	0.0810	0.15000	0.1500
LCD Keypad Display	Gamewell-FCI	LCD-E3	2	0.02400	0.0480	0.02800	0.0560
Addressable Switch Module	Gamewell-FCI	ASM-16	1	0.01100	0.0110	0.01100	0.0110
Transponder Voice Gateway W/ INC-MIC	Gamewell-FCI	INI-VGX	2	0.15000	0.3000	0.15000	0.3000
Amplifier	Gamewell-FCI	AM-50	1	0.08600	0.0860	2.20600	2.2060
Network Repeater	Gamewell-FCI	RPT-E3-FO	1	0.01600	0.0160	0.01700	0.0170
Fiber Loop Module	Gamewell-FCI	FML-E3	2	0.07900	0.1580	0.07900	0.1580
Power Supply Module	Gamewell-FCI	PM-9	1	0.05000	0.0500	0.05000	0.0500
Smoke Detector	Gamewell-FCI	ASD-PL3	97	0.00020	0.0194	0.00200	0.1940
Heat Detector	Gamewell-FCI	ATD-L3	8	0.00020	0.0016	0.00200	0.0160
Pull Station	Gamewell-FCI	MS-7AF	2	0.00030	0.0006	0.00300	0.0060
Aspiration Detector	Vesda	VEP-A00-1P G	1	0.36000	0.3600	0.39000	0.3900
Relay Control Module	Gamewell-FCI	AOM-2RF	26	0.00038	0.0098	0.00650	0.1690
Control Module	Gamewell-FCI	AOM-2SF	2	0.00038	0.0008	0.00650	0.0130
Monitor Module	Gamewell-FCI	AMM-2F	8	0.00038	0.0030	0.00060	0.0048
Dual Monitor Module	Gamewell-FCI	AMM-2IF	2	0.00750	0.0150	0.00570	0.0114
Magnetic Door Holder	Gamewell-FCI	DH	3	0.00009	0.0003	0.00009	0.0003
VAC Circuit - V1	---	---	1	0.00000	0.0000	0.29080	0.2908
VAC Circuit - V2	---	---	1	0.00000	0.0000	0.15600	0.1560
NAC Circuit - N1	---	---	1	0.00000	0.0000	0.30400	0.3040
NAC Circuit - N2	---	---	1	0.00000	0.0000	0.58600	0.5860
			0	0.00000	0.0000	0.00000	0.0000
				Total:	1.1604	Total:	5.0893

Total Standby Amps = 1.160 x 24 Hours = 27.8485 Amp-Hours
Total Alarm Amps = 5.089 x 0.25 Hours = 1.2723 Amp-Hours
(15 minutes)

Total Amp-Hours required after 24 hours standby and 15 minutes alarm.	29.1208	Amp-Hours
Total Battery Amp-Hours required:		
Total Amp-Hours required x 1.2 =	34.9450	Amp-Hours
Total Amp-Hours Supplied=	55.0000	Amp-Hours
Spare Capacity=	20.0550	Amp-Hours

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
VAC/VOICE SIG CKT#: V4

CKT/DEVICE #	V4-1	V4-2	V4-3	V4-4	V4-5	V4-6	V4-7	V4-8	V4-9	V4-10
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	70	30	40	70	20	85	30	0	0	0
AMPS @ DEVICE	0.0208	0.083	0.0208	0.083	0.0208	0.0208	0.0208	0	0	0
AMPS DEVELOPED	0.27	0.2492	0.1662	0.1454	0.0624	0.0416	0.0208	0	0	0
VOLT. DROP	0.095	0.038	0.034	0.051	0.006	0.018	0.003	0.000	0.000	0.000

CKT/DEVICE #	V4-11	V4-12	V4-13	V4-14	V4-15	V4-16	V4-17	V4-18	V4-19	V4-20
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	0	0	0	0	0	0	0	0	0	0
AMPS @ DEVICE	0	0	0	0	0	0	0	0	0	0
AMPS DEVELOPED	0	0	0	0	0	0	0	0	0	0
VOLT. DROP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	V4
TOTAL CKT AMPS.=	0.27 (6.48W)
CIRCUIT LENGTH =	345FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.245
VOLTAGE AT FINAL DEVICE=	20.155
% VOLTAGE DROP=	1.201

SPEAKER LOAD

INTERIOR	.25W =	.0104A
INTERIOR	.5W =	.0208A
EXTERIOR	2W =	.0830A

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
NAC/VISUAL SIG CKT#: N6

CKT/DEVICE #	N6-1	N6-2	N6-3	N6-4	N6-5	N6-6	N6-7	N6-8	N6-9	N6-10
DEVICE	S/V15cd	S/V15cd	S/V15cd	S/V15cd	S/V30cd-C	S/V15cd	S/V15cd	0	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	55	55	60	65	90	50	65	0	0	0
AMPS @ DEVICE	0.022	0.022	0.022	0.06	0.03	0.022	0.022	0	0	0
AMPS DEVELOPED	0.2	0.178	0.156	0.134	0.074	0.044	0.022	0	0	0
VOLT. DROP	0.055	0.049	0.047	0.044	0.034	0.011	0.007	0.000	0.000	0.000

CKT/DEVICE #	N6-11	N6-12	N6-13	N6-14	N6-15	N6-16	N6-17	N6-18	N6-19	N6-20
DEVICE	0	0	0	0	0	0	0	0	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	0	0	0	0	0	0	0	0	0	0
AMPS @ DEVICE	0	0	0	0	0	0	0	0	0	0
AMPS DEVELOPED	0	0	0	0	0	0	0	0	0	0
VOLT. DROP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	N6
TOTAL CKT AMPS.=	0.2
CIRCUIT LENGTH =	442FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.248
VOLTAGE AT FINAL DEVICE=	20.152
% VOLTAGE DROP=	1.214

DEVICE LEGEND

SPEAKER/VISUAL	=S/V
VISUAL DEVICE	=V
CANDELA RATING	=XXcd
CEILING	=C
WALL	=(BLANK)

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
NAC/VISUAL SIG CKT#: N2

CKT/DEVICE #	N2-1	N2-2	N2-3	N2-4	N2-5	N2-6	N2-7	N2-8	N2-9	N2-10
DEVICE	S/V30cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	45	25	75	45	45	70	35	20	20	20
AMPS @ DEVICE	0.022	0.086	0.086	0.022	0.03	0.022	0.022	0.022	0.022	0.022
AMPS DEVELOPED	0.586	0.564	0.478	0.392	0.37	0.34	0.318	0.296	0.274	0.252
VOLT. DROP	0.133	0.071	0.181	0.089	0.084	0.120	0.056	0.030	0.028	0.025

CKT/DEVICE #	N2-11	N2-12	N2-13	N2-14	N2-15	N2-16	N2-17	N2-18	N2-19	N2-20
DEVICE	S/V30cd-C	V15cd-C	S/V75cd	V30cd-C	V15cd-C	V15cd-C	V15cd-C	V15cd-C	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	30	40	30	20	20	20	20	20	0	0
AMPS @ DEVICE	0.03	0.022	0.06	0.03	0.022	0.022	0.022	0.022	0	0
AMPS DEVELOPED	0.23	0.2	0.178	0.118	0.088	0.066	0.044	0.022	0	0
VOLT. DROP	0.035	0.040	0.027	0.024	0.013	0.007	0.004	0.002	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	N2
TOTAL CKT AMPS.=	0.586
CIRCUIT LENGTH =	630FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.969
VOLTAGE AT FINAL DEVICE=	19.431
% VOLTAGE DROP=	4.749

DEVICE LEGEND

SPEAKER/VISUAL	=S/V
VISUAL DEVICE	=V
CANDELA RATING	=XXcd
CEILING	=C
WALL	=(BLANK)

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
VAC/VOICE SIG CKT#: V5

CKT/DEVICE #	V5-1	V5-2	V5-3	V5-4	V5-5	V5-6	V5-7	V5-8	V5-9	V5-10
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	135	30	55	95	55	70	55	40	40	35
AMPS @ DEVICE	0.0208	0.0208	0.0208	0.0208	0.0208	0.083	0.0208	0.0208	0.0208	0.0208
AMPS DEVELOPED	0.4156	0.3948	0.374	0.3532	0.3324	0.3116	0.2286	0.2078	0.187	0.1662
VOLT. DROP	0.283	0.060	0.104	0.169	0.092	0.110	0.063	0.042	0.038	0.029

CKT/DEVICE #	V5-11	V5-12	V5-13	V5-14	V5-15	V5-16	V5-17	V5-18	V5-19	V5-20
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	45	35	30	40	0	0	0	0	0	0
AMPS @ DEVICE	0.083	0.0208	0.0208	0.0208	0	0	0	0	0	0
AMPS DEVELOPED	0.1454	0.0624	0.0416	0.0208	0	0	0	0	0	0
VOLT. DROP	0.033	0.011	0.006	0.004	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	V5
TOTAL CKT AMPS.=	0.4156 (9.97W)
CIRCUIT LENGTH =	760FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	1.044
VOLTAGE AT FINAL DEVICE=	19.356
% VOLTAGE DROP=	5.118

SPEAKER LOAD

INTERIOR	.25W =	.0104A
INTERIOR	.5W =	.0208A
EXTERIOR	2W =	.0830A

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
VAC/VOICE SIG CKT#: V1

CKT/DEVICE #	V1-1	V1-2	V1-3	V1-4	V1-5	V1-6	V1-7	V1-8	V1-9	V1-10
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	35	25	25	30	30	40	25	65	45	25
AMPS @ DEVICE	0.0104	0.0104	0.0104	0.0208	0.083	0.0208	0.0208	0.0208	0.0104	0.083
AMPS DEVELOPED	0.2908	0.2804	0.27	0.2596	0.2388	0.1558	0.135	0.1142	0.0934	0.083
VOLT. DROP	0.051	0.035	0.034	0.033	0.036	0.031	0.017	0.037	0.021	0.010

CKT/DEVICE #	V1-11	V1-12	V1-13	V1-14	V1-15	V1-16	V1-17	V1-18	V1-19	V1-20
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	0	0	0	0	0	0	0	0	0	0
AMPS @ DEVICE	0	0	0	0	0	0	0	0	0	0
AMPS DEVELOPED	0	0	0	0	0	0	0	0	0	0
VOLT. DROP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	V1
TOTAL CKT AMPS.=	0.2908 (6.98W)
CIRCUIT LENGTH =	340FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.307
VOLTAGE AT FINAL DEVICE=	20.093
% VOLTAGE DROP=	1.505

SPEAKER LOAD

INTERIOR	.25W =	.0104A
INTERIOR	.5W =	.0208A
EXTERIOR	2W =	.0830A

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
NAC/VISUAL SIG CKT#: N3

CKT/DEVICE #	N3-1	N3-2	N3-3	N3-4	N3-5	N3-6	N3-7	N3-8	N3-9	N3-10
DEVICE	S/V15cd	S/V15cd	S/V15cd-C	S/V15cd	S/V15cd-C	S/V30cd	S/V15cd-C	S/V75cd	S/V15cd	S/V15cd-C
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	75	85	50	40	30	30	35	45	80	15
AMPS @ DEVICE	0.022	0.022	0.022	0.022	0.022	0.03	0.022	0.06	0.022	0.022
AMPS DEVELOPED	0.296	0.244	0.222	0.2	0.178	0.156	0.126	0.104	0.044	0.022
VOLT. DROP	0.101	0.105	0.056	0.040	0.027	0.024	0.022	0.024	0.018	0.002

CKT/DEVICE #	N3-11	N3-12	N3-13	N3-14	N3-15	N3-16	N3-17	N3-18	N3-19	N3-20
DEVICE	0	0	0	0	0	0	0	0	0	0
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	0	0	0	0	0	0	0	0	0	0
AMPS @ DEVICE	0	0	0	0	0	0	0	0	0	0
AMPS DEVELOPED	0	0	0	0	0	0	0	0	0	0
VOLT. DROP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FORMULA
I X FEET X OHMS / FT

SIGNAL CIRCUIT =	N3
TOTAL CKT AMPS.=	0.266
CIRCUIT LENGTH =	485FT
CKT VOLTAGE=	20.4
TOTAL CKT V.D.=	0.417
VOLTAGE AT FINAL DEVICE=	19.983
% VOLTAGE DROP=	2.044

DEVICE LEGEND

SPEAKER/VISUAL	=S/V
VISUAL DEVICE	=V
CANDELA RATING	=XXcd
CEILING	=C
WALL	=(BLANK)

WIRE SIZE	RESIS. /M FT.	CIRC MILS
6	0.5	26240
10	1.21	10380
12	1.59	6530
14	2.52	4110
16	4.02	2580
18	6.39	1620
20	10.1	1020
22	16.2	640
24	25.7	404

BATTERY CALCULATIONS

PROJECT: SEC H.S. Ph3 BldgL - INX-L
Based on 24 Hour Standby

Device	Manufacturer	#	QTY	Standby Amps	Total Standby Amps	Alarm Amps	Total Alarm Amps
Inteligent Network Voice Gateway	Gamewell-FCI	INI-VGX	1	0.1500	0.150	0.1500	0.150
Amplifier Sub-assembly	Gamewell-FCI	AM-50	2	0.0860	0.172	2.2060	4.412
Power Supply	Gamewell-FCI	PM9	1	0.0500	0.050	0.0500	0.050
**SPEAKER LOADS	----------	----------	------	-------	0.000	-------	0.000
VAC Circuit - V3	---	---	1	0.00000	0.0000	0.33240	0.3324
VAC Circuit - V4	---	---	1	0.00000	0.0000	0.27000	0.2700
VAC Circuit - V5	---	---	1	0.00000	0.0000	0.41560	0.4156
VAC Circuit - V6	---	---	1	0.00000	0.0000	0.14560	0.1456
				0.0000	0.000	0.0000	0.000
				Total:	0.372	Total:	5.776

Total Standby Amps = 0.372 x 24 Hours = 8.928 Amp-Hours
Total Alarm Amps = 5.776 x 0.25 Hours = 1.444 Amp-Hours
(15 minutes)

Total Amp-Hours required after 24 hours standby and 15 minutes alarm.	10.372	Amp-Hours
Total Battery Amp-Hours required:		
Total Amp-Hours required x 1.2 =	12.45	Amp-Hours
Total Amp-Hours Supplied=	18	Amp-Hours
Spare Capacity=	5.554	Amp-Hours

VOLTAGE DROP (VD) CALCULATION

PROJ. NAME: SEC H.S. Ph3 BldgL
VAC/VOICE SIG CKT#: V6

CKT/DEVICE #	V6-1	V6-2	V6-3	V6-4	V6-5	V6-6	V6-7	V6-8	V6-9	V6-10
GAUGE WIRE	14	14	14	14	14	14	14	14	14	14
DISTANCE (FT)	55	55	60	65	90	50	65	0	0	0
AMPS @ DEVICE	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0	0	0
AMPS DEVELOPED	0.1456	0.1248	0.104	0.0832	0.0624	0.0416	0.0208	0	0	0
VOLT. DROP	0.040	0.035	0.031	0.027	0.026	0.010	0.007	0.000	0.000	0.000

| CKT/DE

GENERAL COMMUNICATION PLAN NOTES

A. REFER TO PROJECT TELECOMMUNICATIONS PLANS AND SPECIFICATIONS FOR FURTHER INFORMATION.

B. SIGNAL AND COMMUNICATIONS SYSTEMS RACEWAYS AND BOXES: PROVIDE AND INSTALL 5" SQUARE ("RANDL, INC") RECESSED JUNCTION BOX WITH 1-GANG RING AND (1) 1-1/4" CONDUIT STUB TO ACCESSIBLE CEILING SPACE ABOVE OR UNDER FLOOR SPACE BELOW AS APPLICABLE AT EACH WALL TELECOMMUNICATIONS (PHONE, PHONE/DATA, DATA) OUTLET AND TELEVISION OUTLET LOCATION SHOWN ON THE PLANS UNLESS OTHERWISE NOTED. PROVIDE PATHWAYS BETWEEN COMMUNICATIONS EQUIPMENT ROOM LOCATIONS AND ACCESSIBLE CEILINGS FOR ROUTING OF PHONE/DATA CABLES.

WHERE NO ACCESSIBLE CEILING EXIST; RUN CONDUIT FROM OUTLETS (FLOOR OR WALL) TO COMMUNICATIONS EQUIPMENT LOCATION.

PROVIDE 1-1/4" CONDUIT MINIMUM FOR FLOOR BOX TELECOM AND A/V, AS SHOWN ON TELECOM PLANS.

BEFORE CONSTRUCTION, COORDINATE AND VERIFY TELECOMMUNICATIONS OUTLET LOCATIONS WITH OWNER OR ARCHITECT.

C. PROVIDE EQUIPMENT RACKS, PATCH PANELS, CABLING, TERMINAL BLOCKS & COMPLETE OUTLET ASSEMBLIES.

D. DEVICE LOCATIONS SHOWN ARE SCHEMATIC AND APPROXIMATE. EXACT LOCATIONS SHALL BE FIELD VERIFIED DURING ROUGH-IN WITH ARCHITECTURAL ELEVATIONS, CASEWORK SHOP DRAWINGS, FURNITURE, ETC. AND SHALL BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICT WITH OTHER EQUIPMENT.

E. ELECTRICAL AND COMMUNICATIONS OUTLETS SHOWN IN FIRE RATED, OR SOUND RATED (STC) ASSEMBLIES SHALL BE PROVIDED WITH PUTTY PADS LISTED FOR THE APPLICATION.

F. ELECTRICAL AND COMMUNICATIONS OUTLETS SHOWN IN THE SAME LOCATION, SHALL BE MOUNTED ON OPPOSITE SIDES OF THE SAME STUD. COORDINATE BETWEEN ELECTRICAL AND COMMUNICATIONS PLANS. ALTERNATIVELY, A DEVICE BRACKET MAY BE USED BETWEEN STUDS WITH 4-INCH SEPARATION BETWEEN POWER AND LOW VOLTAGE BOXES.

G. AVOID UNDERGROUND TELECOM CONDUIT RUNS UNLESS NECESSARY. WHERE UNDERGROUND CONDUIT IS USED, TELECOM CABLES SHALL BE WET LISTED.

H. CABLE LADDER DROP-OUTS SHALL BE INSTALLED WHEREVER NECESSARY TO FACILITATE CABLE TRANSITIONS AND MIN BEND RADIUSES. DROP-OUTS SHALL BE EQUIVALENT TO CHATSWORTH AND SOLID ONE PIECE CONSTRUCTION.

I. NO LOW-VOLTAGE SYSTEM MAY USE THE TELECOMMUNICATIONS PATHWAY AS DESCRIBED ON THE TELECOMMUNICATIONS PLANS UNLESS EXPLICITLY ALLOWED. THE FOLLOWING SYSTEMS MAY UTILIZE THE CABLE-TRAY SYSTEM:
- TELECOMMUNICATIONS WIRING (INCLUDES STRICTLY DATA CABLE PLANT AS SPECIFIED)
- SECURITY WIRING (INCLUDES STRICTLY CABLE PLANT AS DESCRIBED ON RISER DIAGRAMS)
- DOOR ACCESS CONTROL WIRING (INCLUDES STRICTLY CABLE PLANT AS DESCRIBED ON RISER DIAGRAMS.

GENERAL AUDIOVISUAL PLAN NOTES

A. REFER TO PROJECT TELECOMMUNICATIONS PLANS AND SPECIFICATIONS, AUDIOVISUAL PATHWAY AND CONNECTIVITY DIAGRAMS FOR FURTHER INFORMATION.

B. INSTALL AV SYSTEMS IN ACCORDANCE WITH CONTRACT DOCUMENTS, MANUFACTURER INSTRUCTIONS/RECOMMENDATIONS AND ALL APPLICABLE CODES.

C. AV SYSTEMS INSTALLER/INTEGRATOR SHALL PROVIDE A FULLY FUNCTIONAL SYSTEM APPROVED BY OWNER AND ENGINEER PRIOR TO JOBSITE CLOSEOUT.

D. SUBMIT ALL AV MATERIALS, COMPONENTS, CABLING, EQUIPMENT, AND SHOP DRAWINGS TO OWNER AND ENGINEER FOR APPROVAL PRIOR TO PROCUREMENT.

E. PROVIDE INITIAL TESTS/ADJUSTMENTS, WRITTEN REPORT, DEMONSTRATION FOR OWNER AND ENGINEER APPROVAL, FINAL ADJUSTMENTS, AND DOCUMENTATION FOR AV SYSTEMS.

F. COORDINATE FINAL SYSTEMS CONTROL, GRAPHICAL USER INTERFACE, PRESENTATION MODES, SEQUENCES, AND MODES OF OPERATION WITH OWNER PRIOR TO FINAL CONFIGURATION.

G. COORDINATE AV SYSTEMS INSTALLATION WORK WITH OWNER REPRESENTATIVE, ENGINEER, GENERAL/SUBCONTRACTORS AND SCHEDULED WORK OF OTHER TRADES.

H. PROVIDE A MINIMUM OF 4 HOURS OF AUDIOVISUAL SYSTEMS CONTROL IN SERVICE TRAINING TO OWNER FOR EACH UNIQUE AUDIOVISUAL SYSTEM CONFIGURATION.

I. ALL TWISTED PAIR AUDIOVISUAL CATEGORY CABLING SHALL BE SHIELDED. VERIFY TWISTED PAIR SHIELDED CATEGORY CABLING AND TERMINATIONS WITH AUDIOVISUAL EQUIPMENT MANUFACTURER PRIOR TO PROCUREMENT.

J. COORDINATE DEVICE LOCATIONS WITH OTHER TRADES PRIOR TO ROUGH-IN IN ORDER TO AVOID CONFLICT WITH FINAL DEVICE INSTALLATIONS (FOR EXAMPLE: AV CONTROL PANELS AND THERMOSTATS). WHERE DEVICES OR EQUIPMENT IS SHOWN AS "OWNER FURNISHED CONTRACTOR INSTALLED" EC SHALL OBTAIN RELEVANT PART NUMBERS FROM OWNER PRIOR TO SUBMITTING SHOP DRAWINGS, AND INSTALL IN ACCORDANCE WITH APPROVED MANUFACTURER PART NUMBERS AND MOUNTING DETAILS.

K. COORDINATE SIZES OF AV RACKS LOCATED WITHIN FRAMED WALL SPACES AND CASEWORK WITH SHOP DRAWINGS PRIOR TO PROCUREMENT.

L. VERIFY DIMENSIONS AND CONDITIONS WITH PLANS, DETAILS, AND JOBSITE CONDITIONS PRIOR TO AV ROUGH-IN

M. PROVIDE AND INSTALL ALL REQUIRED AV SYSTEM CABLING, WIRING, AND CONNECTORS. ALL WIRING SHALL BE IN CONDUIT, UNLESS NOTED OTHERWISE. NO SPLICES SHALL EXIST IN ANY AV CABLING WITHOUT WRITTEN APPROVAL FROM ENGINEER. INSTALL CABLES WITHOUT SHARP BENDS OR DISTORTION.

N. LABEL CABLES AT BOTH ENDS WITH SELF LAMINATING LABELS. HANDWRITTEN LABELS ARE NOT ACCEPTABLE. INCLUDE A SAMPLE/EXAMPLE OF LABELING PRIOR TO PROCUREMENT AND INSTALLATION. PROVIDE ALPHANUMERIC LABELING WITHIN 4" OF EACH CABLE END. COORDINATE CABLE LABELING CONVENTION WITH OWNER.

O. NOTIFY ENGINEER OF ANY DISCREPANCIES OR DISCONTINUATIONS OF PART NUMBERS, SIZES, OR QUANTITIES PRIOR TO PROCUREMENT.

P. PROVIDE ALL REQUIRED ACCESSORIES AND SUPPORT EQUIPMENT ITEMS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.

Q. ENSURE THAT THERE IS ADEQUATE VENTILATION FOR ALL EQUIPMENT FOR WORST-CAST POWER DISSIPATION.

R. MOUNT PROJECTORS AS INDICATED ON PLANS. PROJECTED IMAGES SHALL BE MAXIMUM WIDTH AND HEIGHT CENTERED ON PROJECTION SCREENS AND/OR IMAGE BOARDS.

S. SECURELY MOUNT AND BRACE PROJECTORS AND COMPONENTS SO THAT THERE IS NO VISIBLE VIBRATION OF PROJECTED IMAGE.

TELECOMMUNICATIONS DEVICE SCHEDULE

SYMBOL	BACKBOX	MUD RING	CONDUIT STUB	CABLE TYPE	CABLE QUANTITY	CABLE COLOR	FACEPLATE	NOTES
▽ ▽	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	CAT6	2	BLUE	4-PORT, WHITE	STANDARD WORK AREA OUTLET. PROVIDE BLANK COVERS FOR UNUSED PORTS
▽ TW	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	CAT6	2	BLUE	4-PORT, WHITE	OUTLET SUPPORTING TEACHING WALL AV LOCATED 8'-0" AFF SEE ARCHITECTURAL DETAIL A1-X/A610 UNLESS NOTED OTHERWISE. △3
▽ DISP	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	CAT6	2	BLUE	4-PORT, WHITE	OUTLET SUPPORTING DISPLAY LOCATED 8'-0" AFF SEE ARCHITECTURAL DETAIL A1-X/A610 UNLESS NOTED OTHERWISE.
▽ W	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	CAT6	1	BLUE	1-PORT, SS	WALL PHONE OUTLET, FACEPLATE WITH PHONE-HANGING STUDS MOUNT AT SAME HEIGHT AS WALL CONTROL SWITCHES
△9 ▽ VS CLG	EXTRA DEEP 5-SQUARE	SINGLE GANG	3/4"	CAT6	1	BLUE	1-PORT, SS	FLUSH IN CEILING DATA OUTLET FOR VAPE SENSOR. MOUNT WITHIN 24" OF HVAC GRILLE (VAPE SENSOR BY OWNER)
▼	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	CAT6	1	BLUE	1-PORT, WHITE	STANDARD WORK AREA OUTLET. PROVIDE BLANK COVERS FOR UNUSED PORTS
Ⓥ	SEE ELECTRICAL	-	1-1/4"	CAT6	2	BLUE	4-PORT, WHITE	OUTLET IN FLUSH FLOORBOX. SEE ELECTRICAL DRAWINGS FOR BOX INFORMATION.
(AP)	SEE DETAIL 1/X/T207	-	1-1/4"	CAT6A	2	PURPLE	-	SURFACE MOUNTED OUTLET ('BISCUIT') MOUNTED ABOVE CEILING. CONTRACTOR SHALL MARK CEILING TILE WITH SMALL STICKER FOR OWNER TO LOCATE OUTLET TO INSTALL DEVICE. WAP IS OFOI.
H(AP)	EXTRA DEEP 5-SQUARE	-	1-1/4"	CAT6A	2	PURPLE	-	SURFACE MOUNTED OUTLET ('BISCUIT') MOUNTED IN RECESSED BACKBOX. WAP IS OFOI.
H(AP) WP	SEE DETAIL 5/X/T207	-	1-1/4"	CAT6A	2	PURPLE	-	SURFACE MOUNTED OUTLET ('BISCUIT') MOUNTED IN RECESSED WEATHERPROOF BACKBOX. COORDINATE FINAL HEIGHT WITH ARCHITECHTUAL. WAP IS OFOI.
WP	EXTRA DEEP 5-SQUARE	-	3/4"	CAT6	1	ORANGE	N/A	SURFACE MOUNTED OUTLET ('BISCUIT') IN WEATHERPROOF BACKBOX DATA CABLE ONLY, CAMERA IS OFOI.
(CEILING)	SEE NOTES	-	3/4"	CAT6	1	ORANGE	N/A	SURFACE MOUNTED OUTLET ('BISCUIT') SECURED TO STRUCTURE ABOVE ACCESSIBLE CEILINGS. CONTRACTOR SHALL MARK CEILING TILE WITH SMALL STICKER FOR OWNER TO LOCATE OUTLET TO INSTALL DEVICE. CAMERA IS OFOI.
(WALL)	EXTRA DEEP 5-SQUARE	SINGLE GANG	3/4"	CAT6	1	ORANGE	1-PORT, WALL	FLUSH MOUNTED OUTLET IN WALL. CAMERA IS OFOI.
S	EXTRA DEEP 5-SQUARE	SINGLE GANG	3/4"	CAT6	1	RED	1-PORT, WHITE	FLUSH MOUNTED DATA OUTLET. SPEAKER/CLOCK COMBO IS OFOI.
AV	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	-	-	-	BRUSH COVER	FLUSH MOUNTED BACKBOXES IN WALL FOR HDMI CABLE PASS-THROUGH. ONE BACKBOX BEHIND DISPLAY AT +84"AFF AND ONE BENEATH DISPLAY AT +15"AFF. BACKBOXES SHALL BE CONNECTED WITH CONDUIT PER SCHEDULE. NOTE: BOX BENEATH DISPLAY SHALL BE LOCATED ABOVE COUNTER TOP WHERE DISPLAYS ARE LOCATED ABOVE COUNTER TOPS. COORDINATE LOCATIONS ABOVE COUNTER TOPS WITH ARCH PRIOR TO ROUGH-IN.
DISP	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	-	-	-	BRUSH COVER	FLUSH MOUNTED BACKBOX BEHIND DISPLAY WITH CONDUIT STUB TO NEAREST ACCESSIBLE CEILING FOR FUTURE OFOI OWNER AV CABLING, VERIFY HEIGHT WITH ARCHITECTURAL PLANS
TW	EXTRA DEEP 5-SQUARE	DOUBLE GANG	(2) 1"	-	-	-	BRUSH COVER	FLUSH MOUNTED BACKBOX BEHIND DISPLAY WITH CONDUIT STUB TO NEAREST ACCESSIBLE CEILING FOR FUTURE OFOI OWNER AV CABLING. MOUNTED AT +84" AFF UNLESS NOTED OTHERWISE.
	PER MFGRS REQUIREMENTS	-	3/4"	CAT6	1	RED	N/A	WALL MOUNTED DATA OUTLET. SPEAKER IS OFOI. △3
WP	PER MFGRS REQUIREMENTS	-	3/4"	CAT6	1	RED	N/A	SURFACE MOUNTED OUTLET ('BISCUIT') IN WEATHERPROOF BACKBOX DATA CABLE ONLY, IP SPEAKER IS OFOI.
AV-R	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	AV SHIELDED	1	BLACK	N/A	FLUSH IN WALL HDBASET RECEIVER FOR SIGNAL BEHIND DISPLAY.
AV-4	EXTRA DEEP 5-SQUARE	SINGLE GANG	1-1/4"	AV SHIELDED	4	BLACK	4-PORT, WHITE	FLUSH IN WALL HDBASET CABLING OUTLET FOR HDBASET SIGNAL DISTRIBUTION FROM HDBASET SIGNAL SPLITTER. COORDINATE FINAL LOCATION WITH OWNER IT REPRESENTATIVE PRIOR TO ROUGH-IN.
△3 DR	PER MFGRS REQUIREMENTS	-	3/4"	22-8 SHIELDED	1	TBD	-	SECURITY DOOR CONTACTS. CONTRACTOR SHALL COORDINATE FINAL ROUGH-IN WITH ACCESS CONTROL VENDOR, DOOR HARDWARE SPECIFICATIONS, DOOR SCHEDULE, AND ARCHITECTURAL PLANS PRIOR TO DOOR PREP/ROUGH-IN.
GB	PER MFGRS REQUIREMENTS	-	3/4"	22-8 SHIELDED	1	TBD	-	SECURITY GLASS BREAK DEVICE. CONTRACTOR SHALL COORDINATE FINAL ROUGH-IN WITH ACCESS CONTROL VENDOR, DOOR HARDWARE SPECIFICATIONS, DOOR SCHEDULE, AND ARCHITECTURAL PLANS PRIOR TO DOOR PREP/ROUGH-IN.
KP	PER MFGRS REQUIREMENTS	-	1"	CAT6 & 22-8 SHIELDED	1 EACH	TBD	-	SECURITY KEYPAD: TO BE MOUNTED AT 5' TO THE BOTTOM BOX, APPROXIMATELY 18" TO 28" FROM THE EDGE OF A WALL OR DOOR OPENING. CONTRACTOR SHALL COORDINATE FINAL ROUGH-IN WITH ACCESS CONTROL VENDOR, DOOR HARDWARE SPECIFICATIONS, DOOR SCHEDULE, AND ARCHITECTURAL PLANS PRIOR TO DOOR PREP/ROUGH-IN.
△9	EXTRA DEEP	DOUBLE GANG	3/4"	BELDEN-9740	1 EACH	TBD	-	RECORDING LIGHT. CONTRACTOR SHALL PROVIDE 2-GANG DOUBLE-DEPTH BOX WITH BELDEN-9740 HOMERUN TO AV RACK.

GENERAL NOTES:
1. ALL CONDUIT STUBS FROM BACKBOXES SHALL BE ROUTED TO ABOVE NEAREST ACCESSIBLE CEILING SPACE WITH ACCESS TO PRIMARY PATHWAY BACK TO IDF OR MDF, UNLESS NOTED OTHERWISE
2. CONFIRM ALL DEVICE HEIGHTS WITH ARCHITECTURAL ELEVATIONS PRIOR TO ROUGH IN AND COORDINATE FINAL LOCATIONS WITH NEARBY DEVICE DICSIPLINES.
3. COORDINATE ALL ROUGH-IN FOR OFOI DEVICES WITH OWNER IT REPRESENTATIVE PRIOR TO ROUGH-IN.

1 TELECOM DEVICE CABLE AND ROUGH-IN SCHEDULE

SCALE: NTS

Manufacturer	Part Number	Description	Color/Finish
Extron	DTP HD DA4 4K 230	HDBaseT signal splitter with (1) HDMI loop-through and (4) HDBaseT out.	Black
Extron	DA2 HD 4K	HDMI splitter behind display. (1) HDMI In (2) HDMI Out	Black
Extron	DTP R HWP 4K 231 D	HDBaseT receive	Black
Extron	XTP DTP 24	Shielded Category cabling compliant with A/V HDBaseT end devices	Black
Cables Plus	LV0249C510IN1	24-Strand AFL I/O OFNR Dry Core Strand AFL Singlemode Fiber 9/125 (G.652D)	Black
Panduit	FRME1U	1RU fiber Splice Enclosure	Black
Corning	SOC-LCU-900-SM	LC to LC Fiber Patch Cable	Blue
Panduit	FRME3	3RU fiber Splice Enclosure	Black
Panduit	FAP6WBUDLCZ	Fiber Adapter Panel loaded with LC Duplex OS2 Fiber Adapters	Blue
Chatsworth	46353-703	19" Two-post Telecommunications rack	Black
Chatsworth	10250-712	12" Wide Cable Runway	Black
Chatsworth	35441-702	2U Horizontal Wire Manager w/cable pass-through ports	Black
Chatsworth	35511-703	6" Vertical Wire Manager - Single Sided	Black
Panduit	CPP24FMWBLY	24 Port 1RU Mini-Com Flush Mount	Black
Panduit	CPP48FMWBLY	48 Port 2RU Mini-Com Flush Mount	Black
General Cable	GenSPEED 6000	Category 6 network cabling	Varies per plan
Panduit	UTPSP*Y	Category Copper Patch Cords	Varies per plan
General Cable	GenSPEED 10	Category 6A network cabling	Purple
Panduit	CFPL21WY	Data Faceplate	Confirm with Architect
Panduit	CFPL41WY	4-Port Data Faceplate	Confirm with Architect
Panduit	KWP6PY	1-Port Phone plate and module	Confirm with Architect
Panduit	CJ688TG*	CAT6 Keystone Jack	Varies per plan
Panduit	CJ6X88TG*	CAT6A Keystone Jack	Purple
Listen	LS-88	Portable Assistive Listening System	N/A

2 TELECOM BASIS OF DESIGN (BOD)

SCALE: NTS

DSA File No.:
DSA File

DSA Application No.:
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☐ Sheet Reference Notes

△3

COORDINATION MEETING WITH DISTRICT

- PRIOR TO THE INSTALLATION OF THE PATHWAY, AND AFTER THE METAL FRAMING IS NEAR COMPLETE, HOLD A SET OF MEETINGS AND REVIEW THE FOLLOWING SYSTEMS.
- CAMERA LOCATIONS, WALL MOUNT AND CEILING LOCATIONS.
- DATA OUTLETS LOCATIONS, AND ADJACENT POWER OUTLETS.
- TEACHING WALL LOCATIONS AND THE PLACEMENT OF THE INSTRUCTIONAL TECHNOLOGY MONITORS.
- SCIENCE ROOMS, AND TECHNOLOGY PATHWAY WITH JUNCTION BOXES (J) THAT WILL SUPPORT A NETWORKED SYSTEM OF MONITORS IN THE ROOM.
- WALL MOUNTED PHONE LOCATIONS.
- WIRELESS ACCESS POINTS (AP) ROUGH IN LOCATIONS.
- VAPE SENSORS (VS) ROUGH IN LOCATIONS IN STUDENT RESTROOMS.
- CLOCK SPEAKER ROUGH IN LOCATIONS.

General Notes

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COMMUNICATIONS GENERAL NOTES AND SCHEDULE
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LICENSED ARCHITECT RODNEY K. FENG No. C23724 REG. 4-30-27 STATE OF CALIFORNIA
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No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

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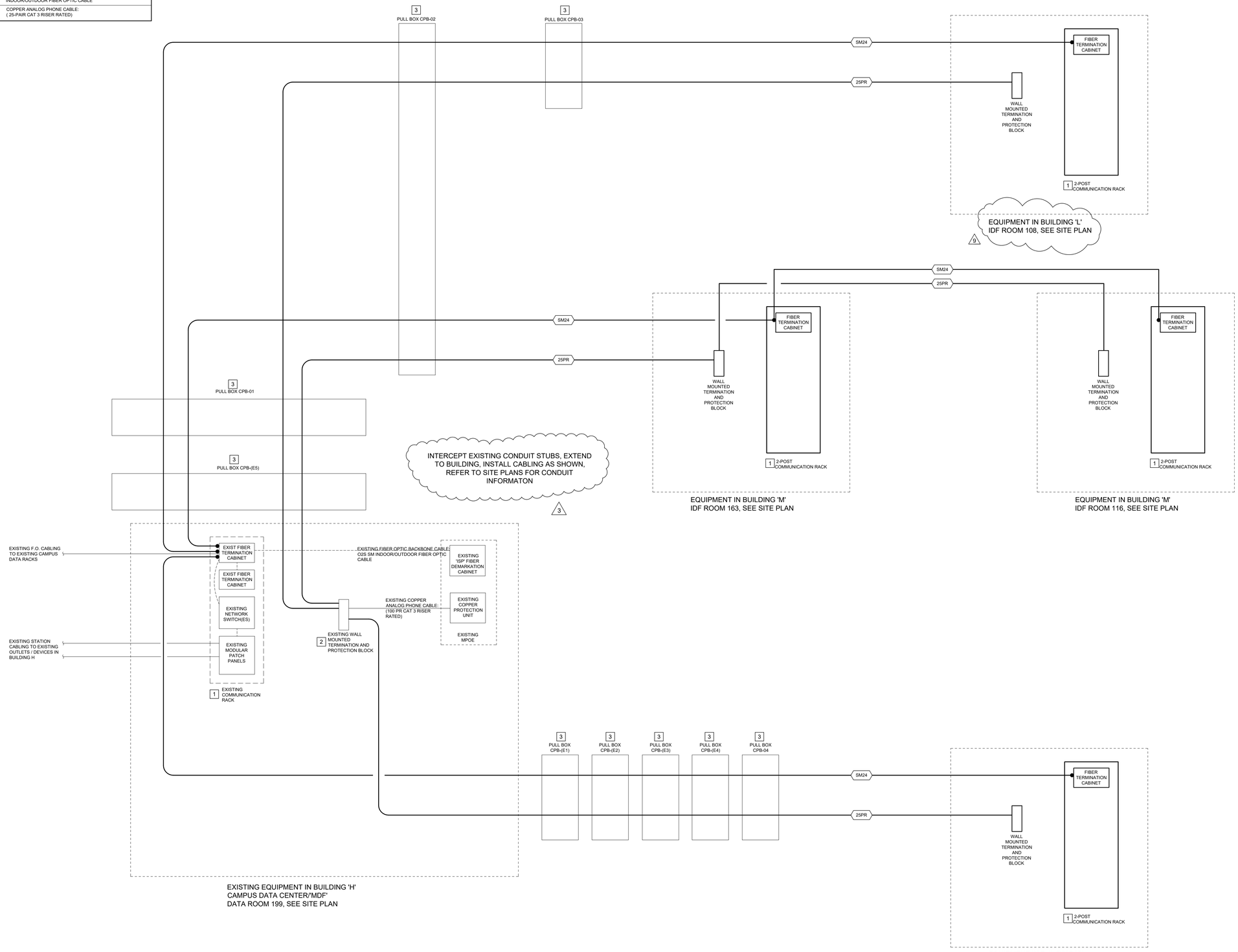
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CABLE / SYMBOL SCHEDULE

SM24	FIBER OPTIC BACKBONE CABLE: 24-STRAND OS2S SM INDOOR/OUTDOOR FIBER OPTIC CABLE
25PR	COPPER ANALOG PHONE CABLE: (25-PAIR CAT 3 RISER RATED)



1 SITE COMMUNICAITONS RISER DIAGRAM

SCALE: NTS

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

1. TERMINATE NEW FIBER IN EXISTING TELECOMMUNICATIONS RACK IN EXISTING TELECOMMUNICATION ROOM IN BUILDING H. COORDINATE FINAL LOCATION OF FIBER TERMINATIONS WITH OWNER PRIOR TO INSTALLATION.
2. EXISTING BUILDING ENTRANCE 110-STYLE BLOCKS WITH FUSED PROTECTION FOR INCOMING CAT3 TELEPHONE TRUNK CABLE, TERMINATE NEW CABLING ON EXISTING PUNCH DOWN BLOCK(S), FIELD VERIFY EXACT LOCATION AND COMPLETE INFORMATION.
3. PULL BOX FOR CONDUIT / CABLING ROUTING, SEE SITE PLAN FOR LOCATIONS, (E) INDICATES EXISTING PULL BOX, SEE COMMUNICATION PULL BOX SCHEDULE ON SHEET X/E104.

COORDINATION MEETING WITH DISTRICT

- PRIOR TO THE INSTALLATION OF THE PATHWAY, AND AFTER THE METAL FRAMING IS NEAR COMPLETE, HOLD A SET OF MEETINGS AND REVIEW THE FOLLOWING SYSTEMS.
- CAMERA LOCATIONS, WALL MOUNT AND CEILING LOCATIONS.
- DATA OUTLETS LOCATIONS, AND ADJACENT POWER OUTLETS.
- TEACHING WALL LOCATIONS AND THE PLACEMENT OF THE INSTRUCTIONAL TECHNOLOGY MONITORS.
- SCIENCE ROOMS, AND TECHNOLOGY PATHWAY WITH JUNCTION BOXES (J) THAT WILL SUPPORT A NETWORKED SYSTEM OF MONITORS IN THE ROOM.
- WALL MOUNTED PHONE LOCATIONS.
- WIRELESS ACCESS POINTS (AP) ROUGH IN LOCATIONS.
- VAPE SENSORS (VS) ROUGH IN LOCATIONS IN STUDENT RESTROOMS.
- CLOCK SPEAKER ROUGH IN LOCATIONS.

3

GENERAL NOTES

A. ALL WORK SHOWN IS NEW, UNLESS NOTED OTHERWISE.

B. ALL WORK SHOWN IS PART OF THE BASE BID, UNLESS NOTED OTHERWISE.

C. STATION OUTLETS SHALL MATCH CABLE PLANT IN COLOR.

D. NETWORK SWITCH EQUIPMENT PROVIDED AND INSTALLED BY OWNER.

E. CATEGORY PATCH CABLES SHALL MATCH CABLE PLANT IN COLOR AND SHALL BE NO LONGER THAN 2 METERS.

F. 10' SERVICE LOOPS ARE REQUIRED FOR ALL NEW CABLING AT EACH EXISTING AND NEW PULL BOX LOCATIONS.

G. ALL EQUIPMENT NOTED AS PROVIDED BY OWNER SHALL BE INSTALLED BY CONTRACTOR UNLESS OTHERWISE NOTED. EC SHALL NOTIFY OWNER IT REPRESENTATIVE AT CONTRACT "NOTICE TO PROCEED" OF OWNER REQUIRED EQUIPMENT, SO THAT OWNER MAY COORDINATE EQUIPMENT PROCUREMENT IN TIME FOR CONSTRUCTION COMPLETION.

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LICENSED ARCHITECT — RUSSELL K. FENNELL — No. C23724 — EXP. 4-30-27 — STATE OF CALIFORNIA
Architect

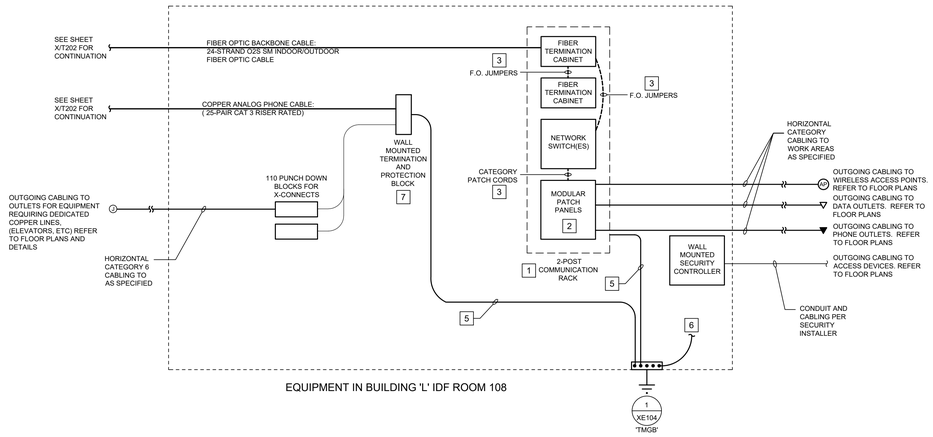
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9	DSA ADDENDUM 10	10/02/26

Revision

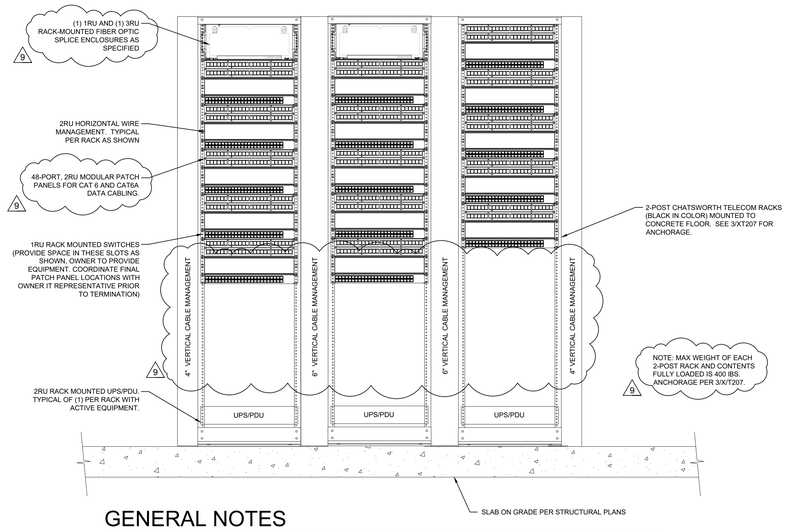
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EQUIPMENT IN BUILDING 'L' IDF ROOM 108



GENERAL NOTES

1. ALL HARDWARE NOTED AS PROVIDED BY OWNER SHALL BE BROUGHT TO THE ATTENTION OF OWNER REPRESENTATIVE AT NOTICE TO PROCEED FOR SCHEDULING OF EQUIPMENT ARRIVAL WITHIN CONSTRUCTION TIMELINE. ALL HARDWARE SHALL BE INSTALLED BY THE ELECTRICAL CONTRACTOR UNLESS OTHERWISE NOTED.
2. TELECOMMUNICATIONS EQUIPMENT SHOWN IS TYPICAL. REFER TO ENLARGED ROOM PLANS AND RISER DIAGRAM FOR EQUIPMENT AND CABLE QUANTITIES.
3. CONFIRM EQUIPMENT RACK LAYOUT WITH FINAL CABLE QUANTITY AND OWNER IT REPRESENTATIVE PRIOR TO ROUGH IN. DETAIL SHOWN IS FOR GENERAL COORDINATION AND LAYOUT.

1 IDF RACK ELEVATION - BLDG L ROOM 108

SCALE: NTS

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

1. 2-POST COMMUNICATIONS RACK. REFER TO DETAIL ON THIS SHEET AND ENLARGED PLANS FOR RACK LOCATIONS AND QUANTITIES.
2. PROVIDE AND INSTALL MODULAR PATCH PANELS, VERTICAL AND HORIZONTAL WIRE MANAGEMENT AS REQUIRED, REFER TO ELEVATION DETAIL ON THIS SHEET.
3. PATCH CABLES BETWEEN NETWORK SWITCHES AND PATCH PANELS SHALL BE PROCURED BY EC AND INSTALLED BY OWNER.
4. #6 AWG, THWN, GREEN JACKETED GROUND CONDUCTOR BETWEEN TELECOMMUNICATIONS ROOM GROUND BUS BAR AND ALL DISTRIBUTED RACK-EQUIPMENT WITHIN BUILDING.
5. #6 AWG, THWN, GREEN JACKETED GROUND CONDUCTOR BETWEEN TELECOMMUNICATIONS ROOM GROUND BUS BAR AND TELECOMMUNICATION ROOM RACK EQUIPMENT, INCLUDING CABLE-TRAY, 2-POST RACKS, ETC. REFER TO DETAILS FOR CONDUCTOR TERMINATION REQUIREMENTS.
6. #2 AWG, THWN, GREEN JACKETED GROUND CONDUCTOR BETWEEN TELECOMMUNICATIONS ROOM GROUND BUS BAR AND MAIN ELECTRICAL SERVICE EQUIPMENT GROUND BUS ELECTRICAL ROOM. ROUTE IN 1" CONDUIT.
7. CIRCAMAX BUILDING ENTRANCE 110-STYLE PUNCH DOWN BLOCKS WITH FUSED PROTECTION FOR INCOMING CAT3 TELEPHONE TRUNK CABLE.

General Notes

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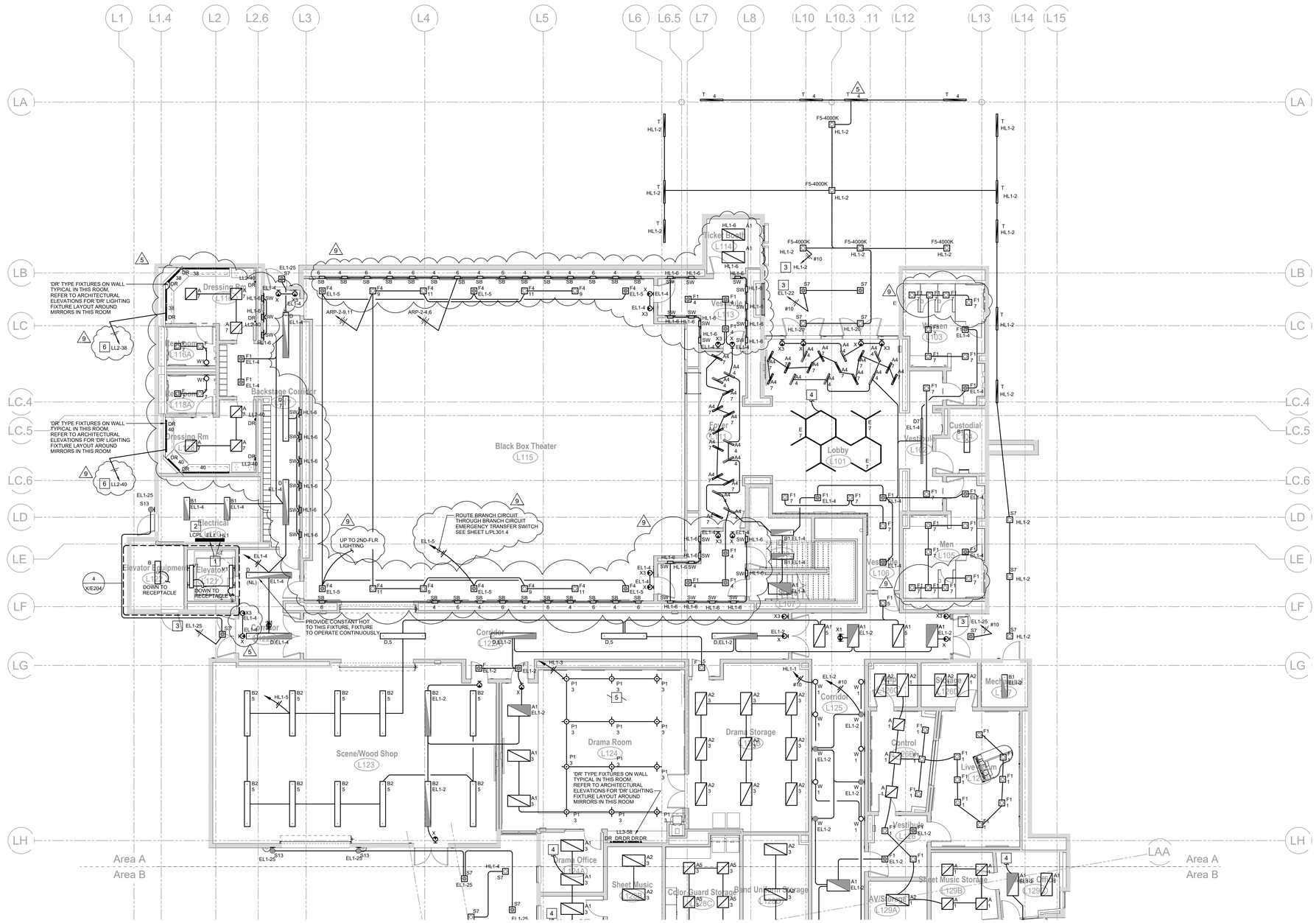
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NOTE:
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BUILDING L FIRST FLOOR LIGHTING PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
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Sheet Reference Notes

1. ELECTRICAL PANEL, SEE SINGLE LINE DIAGRAM AND REFER TO PANEL SCHEDULES.
2. LIGHTING CONTROL PANEL, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
3. ROUTE BRANCH CIRCUIT THROUGH LIGHTING CONTROLS, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
4. PROVIDE BRANCH CIRCUIT DOWN TO ROOM CONTROLLED RECEPTACLE(S), REFER TO ELECTRICAL PLANS. FOR CLARIFICATION BRANCH CIRCUIT IS NOT SHOWN.TYPICAL AT ALL OFFICES, LOBBIES, CONFERENCE ROOMS AND BREAK ROOMS.
5. ALL PENDANT FIXTURES IN THIS ROOM ARE TO BE MOUNTED 1'-0" ABOVE PIPE GRID.
6. ROUTE LIGHTING BRANCH CIRCUIT THROUGH DRESSING ROOM CONTROLS CONTACTOR, SEE SHEET L/E201.4 FOR CONTACTOR INFORMATION.

REFER TO SHEET L/E101LC.4 FOR REQUIRED DETAILED BUILDING LIGHTING CONTROLS AND INFORMATION.

General Notes

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BUILDING L FIRST FLOOR LIGHTING PLAN AREA B

SCALE: 1/8"=1'-0"

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Sheet Reference Notes

1. ELECTRICAL PANEL, SEE SINGLE LINE DIAGRAM AND REFER TO PANEL SCHEDULES.
2. LIGHTING CONTROL PANEL, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
3. ROUTE BRANCH CIRCUIT THROUGH LIGHTING CONTROLS, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
4. PROVIDE BRANCH CIRCUIT DOWN TO ROOM CONTROLLED RECEPTACLE(S), REFER TO ELECTRICAL PLANS. FOR CLARIFICATION BRANCH CIRCUIT IS NOT SHOWN.TYPICAL AT ALL OFFICES, LOBBIES, CONFERENCE ROOMS AND BREAK ROOMS.

REFER TO SHEET L/E102LC.4 FOR REQUIRED DETAILED BUILDING LIGHTING CONTROLS AND INFORMATION.

9

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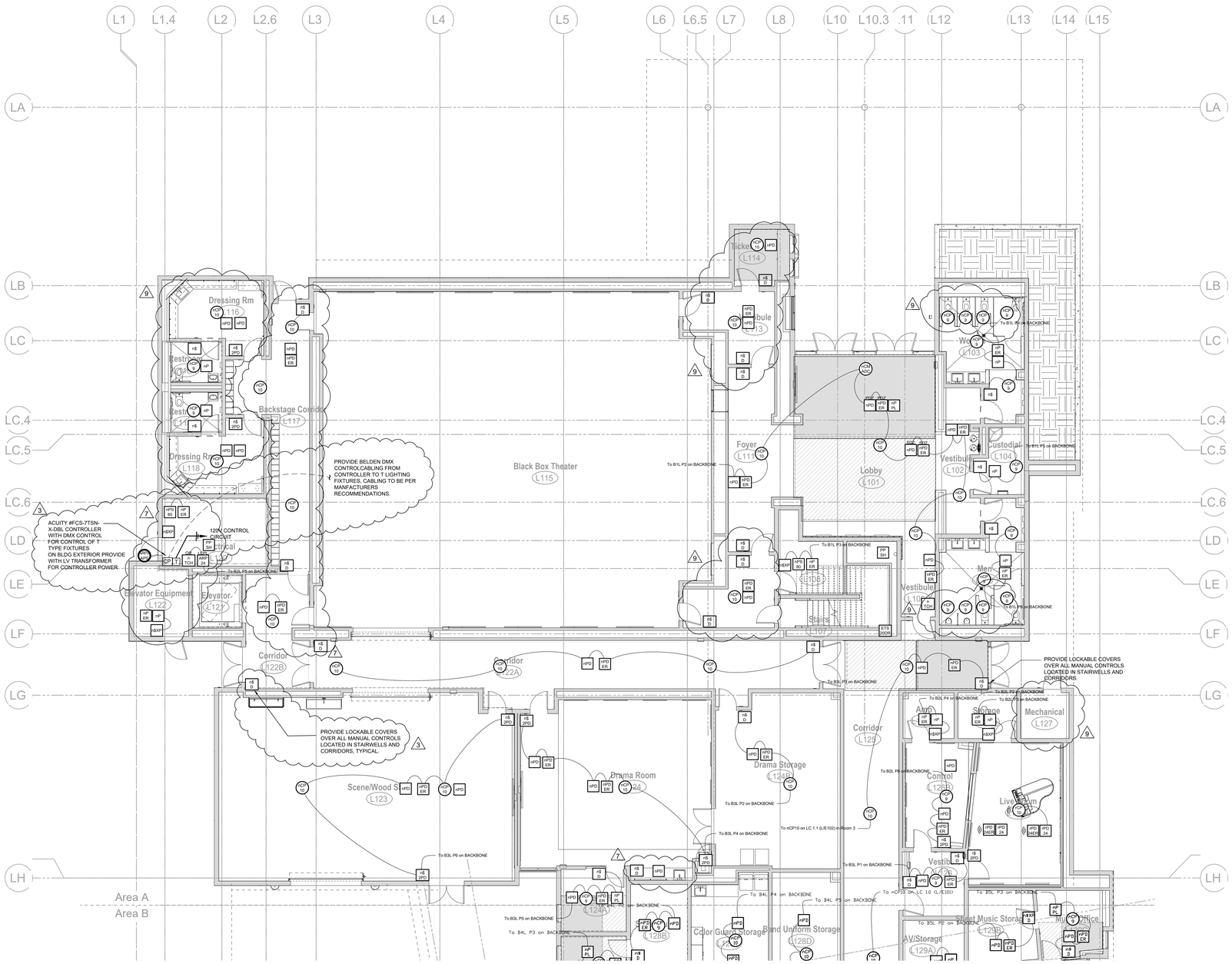
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BUILDING L FIRST FLOOR LIGHTING CONTROLS PLAN PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
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☐ Sheet Reference Notes

LIGHTING CONTROLS LEGEND

- ARP24 — ARP 24 — ARP INTENC32 NLT 24FCR MVOLT 2VB HLK SM — Acuity Relay Panel, Include INC and ENC, 32-size, nLight, 24-relays (40A), 120-277 VAC, 2- Voltage Barrier, Hinge Locking, Surface Mount
- ARPA APS — ARPA APS — ARPA APS OL — Acuity Relay Panel accessory, Analog sensor, Outdoor
- ETS 20DR — ETS20 DR M20 — Emergency Control Device, 0-10V Dimming Relays
- n TCH — NPOD TOUCH XX — Low Voltage Wallpod, Touchscreen Wall Control
- n$ — NPODMA XX — nLight Wired Aesthetic Wallpod
- n$ 2PD — NPODMA 2P DX XX — nLight Wired Aesthetic Wallpod, 2-Pole, Raise/Lower Dimming Without Wires
- n$ D — NPODMA DX XX — nLight Wired Aesthetic Wallpod, Raise/Lower Dimming Without Wires
- n$XP — NWSXA PDT LV XX — Aesthetic Wall Switch Occupancy Sensor, Passive Dual Technology, Low Voltage
- nCM ADC — NCM ADCX — Low Voltage Ceiling Mount Sensor, Photocontrol w/ Auto Dimming; No Wires
- nCP 10 — NCM PDT 10 RJB — Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Large Motion / Extended Range 360° Lens, Rear RJ-45 Ports
- nCP 9 — NCM PDT 9 RJB — Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Small Motion / Standard Range 360° Lens, Rear RJ-45 Ports
- nP — NPP16 EFP — Power/Relay Pack, External Fault Protection
- nP ER — NPP16 ER EFP — Power/Relay Pack, UL924 Emergency Operation, External Fault Protection
- nP PL — NPP20 PL — Plug Load
- nPD — NPP16 D EFP — Power/Relay Pack, Occupancy Controlled Dimming, External Fault Protection
- nPDER — NPP16 D ER EFP — Power/Relay Pack, Occupancy Controlled Dimming, UL924 Emergency Operation, External Fault Protection
- nPS80 — NPS 80 — Power Supply, 80 mA
- PP SH — PPSH — PP16 SHUNT EFP — Bypass Relay Pack, Shunt
- r$2PD — RPODBA 2P DX XX G2 — nLight Preset Wall control, 2-Pole, Raise/Lower Dimming Without Wires, Generation Two
- rCP 10 — RCMS PDT 10 G2 — Networked nLight AIR occupancy and daylight sensor, Passive Dual Technology, Large Motion / Extended Range 360° Lens, Generation Two
- rPD 24 — RPP20 D 24V EFP G2 — nLight Air Power/Relay Pack, Networked Version, Dimming Side Output, 24 volt output, Generation Two
- rPD24ER — RPP20 D 24V ER EFP G2 — nLight Air Power/Relay Pack, Networked Version, Dimming Side Output, 24 volt output, UL924 Emergency Operation, Generation Two

General Notes

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BUILDING L FIRST FLOOR
LIGHTING CONTROLS PLAN
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Drawing

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No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

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Checked By:
Date: 08/27/24
Reviewed By:

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T24 DAYLIGHT AREAS

SOLID SHADING DEPICTS
PRIMARY SIDELIT DAYLIGHT ZONE

DOT PATTERN SHADING DEPICTS
SECONDARY SIDELIT DAYLIGHT ZONE

CROSS HATCH SHADING DEPICTS
PRIMARY SKY LIT DAYLIGHT ZONE



BUILDING L FIRST FLOOR LIGHTING CONTROLS PLAN PLAN AREA B

SCALE: 1/8"=1'-0"

DSA File No.:
DSA File

DSA Application No.:
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LIGHTING CONTROLS LEGEND

- n$ — nPODMA XX — nLight Wired Aesthetic Wallpod
- n$ D — nPODMA DX XX — nLight Wired Aesthetic Wallpod, Raise/Lower Dimming Without Wires
- n$XP — NWSXA PDT LV XX — Aesthetic Wall Switch Occupancy Sensor, Passive Dual Technology, Low Voltage
- n$XPD — NWSXA PDT LV DX XX — Aesthetic Wall Switch Occupancy Sensor, Passive Dual Technology, Low Voltage, Raise/Lower Dimming Without Wires
- nCM ADC — NCM ADCX — Low Voltage Ceiling Mount Sensor, Photocontrol w/ Auto Dimming; No Wires
- nCP 10 — NCM PDT 10 RJB — Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Large Motion / Extended Range 360° Lens, Rear RJ-45 Ports
- nCP 9 — NCM PDT 9 RJB — Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Small Motion / Standard Range 360° Lens, Rear RJ-45 Ports
- nP — NPP16 EFP — Power/Relay Pack, External Fault Protection
- nP ER — NPP16 ER EFP — Power/Relay Pack, UL924 Emergency Operation, External Fault Protection
- nP PL — NPP20 PL — Plug Load
- nPD — NPP16 D EFP — Power/Relay Pack, Occupancy Controlled Dimming, External Fault Protection
- nPD ER — NPP16 D ER EFP — Power/Relay Pack, Occupancy Controlled Dimming, UL924 Emergency Operation, External Fault Protection
- r$ 4SD — RPODBA 4S DX XX G2 — nLight Preset Wall control, 4 scene control, Raise/Lower Dimming Without Wires, Generation Two
- r$ D — RPODBA DX XX G2 — nLight Preset Wall control, Raise/Lower Dimming Without Wires, Generation Two
- rCP 10 — RCMS PDT 10 G2 — Networked nLight AIR occupancy and daylight sensor, Passive Dual Technology, Large Motion / Extended Range 360° Lens, Generation Two
- rPD 24 — RPP2D 0 24V EFP G2 — nLight Air Power/Relay Pack, Networked Version, Dimming Side Output, 24 volt output, Generation Two
- rPD 24ER — RPP2D 0 24V ER EFP G2 — nLight Air Power/Relay Pack, Networked Version, Dimming Side Output, 24 volt output, UL924 Emergency Operation, Generation Two

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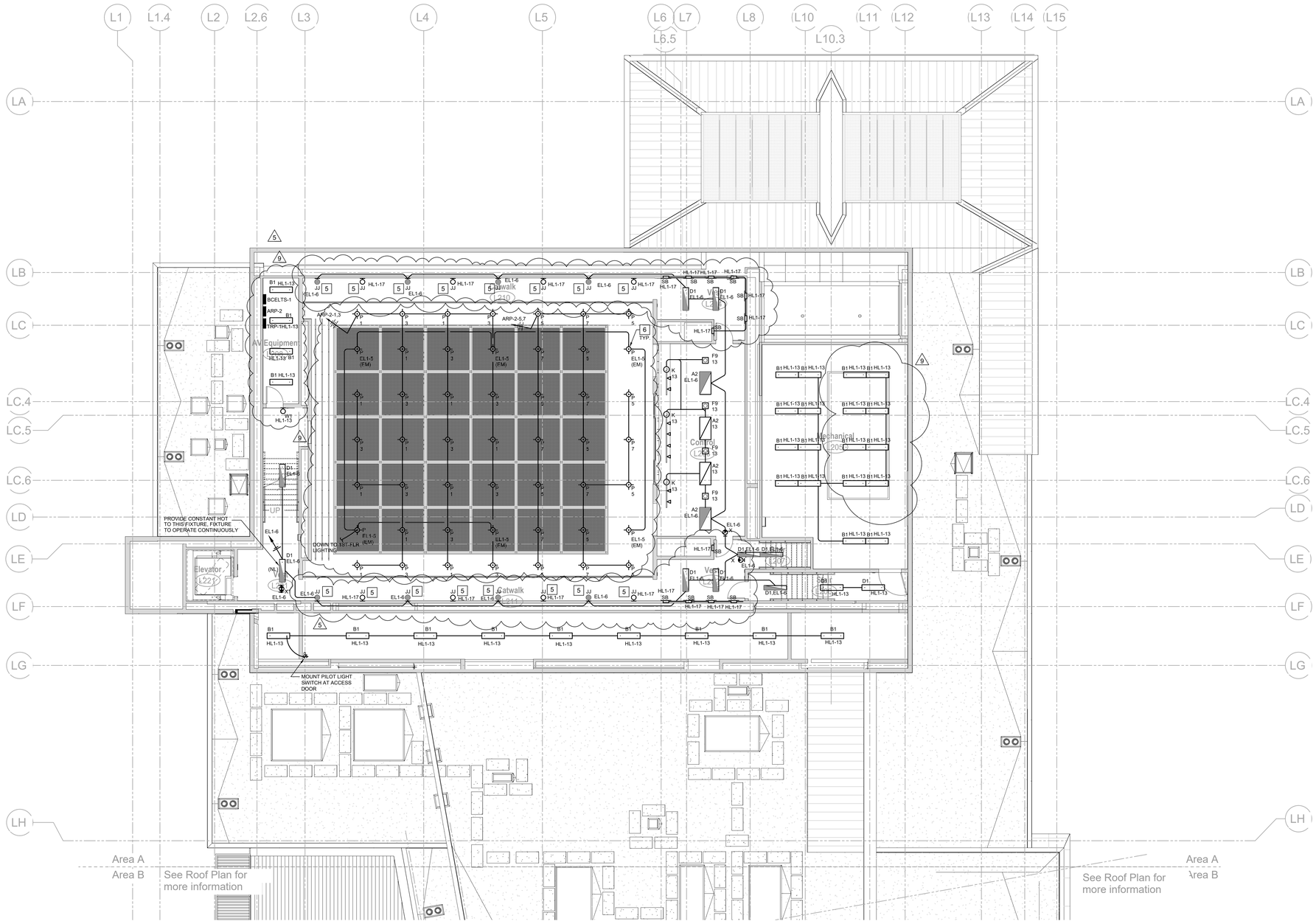
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NOTE:
FOR CLARIFICATION, SOME HOMERUNS HAVE NOT BEEN SHOWN ON THIS SHEET. CONTRACTOR TO PROVIDE ALL REQUIRED HOMERUNS. REFER TO PANEL SCHEDULES FOR CONDUCTORS SIZES.

BUILDING L SECOND FLOOR LIGHTING PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
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Sheet Reference Notes

1. ELECTRICAL PANEL, SEE SINGLE LINE DIAGRAM AND REFER TO PANEL SCHEDULES.
2. LIGHTING CONTROL PANEL, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
3. ROUTE BRANCH CIRCUIT THROUGH LIGHTING CONTROLS, SEE LIGHTING CONTROL DIAGRAM ON SHEET X/E301.
4. PROVIDE BRANCH CIRCUIT DOWN TO ROOM CONTROLLED RECEPTACLE(S), REFER TO ELECTRICAL PLANS. FOR CLARIFICATION BRANCH CIRCUIT IS NOT SHOWN,TYPICAL AT ALL OFFICES, LOBBIES, CONFERENCE ROOMS AND BREAK ROOMS.
5. MOUNT FIXTURE ABOVE CATWALK.
6. MOUNT FIXTURES AT 7'-0" ABOVE WALKING SURFACE OF TENSION GRID.

REFER TO SHEET L/E103.LC.4 FOR REQUIRED DETAILED BUILDING LIGHTING CONTROLS AND INFORMATION.

General Notes

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Exp. 4-30-27
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Architect

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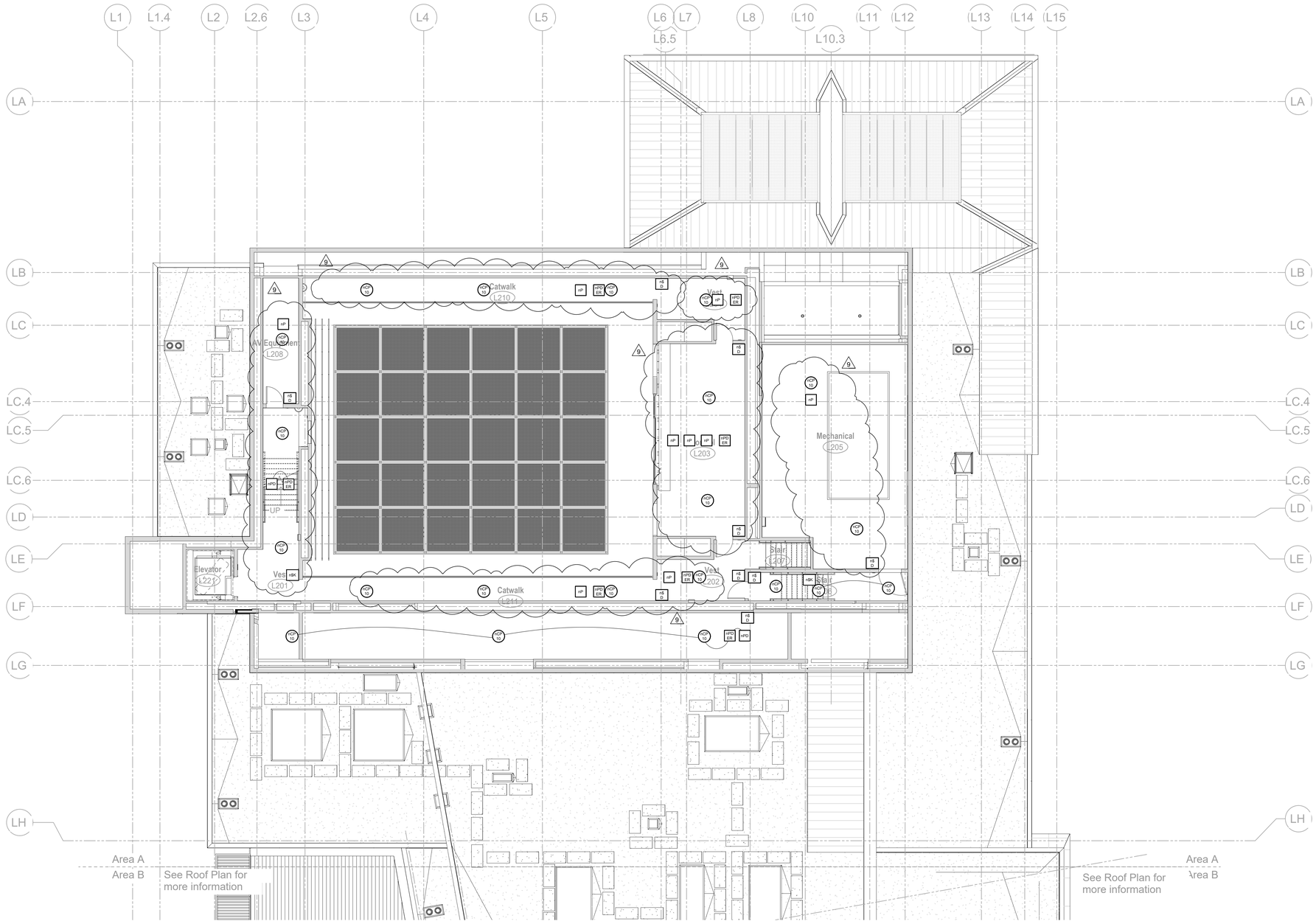
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BUILDING L SECOND FLOOR LIGHTING CONTROLS PLAN PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

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DSA File

DSA Application No.:
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LIGHTING CONTROLS LEGEND

ARP24 — ARP 24
ARP INTENC32 NLT 24FCR MVOLT 2VB HLK SM
Acuity Relay Panel, Include INC and ENC, 32-size, nLight, 24-relays (40A), 120-277 VAC, 2- Voltage Barrier, Hinge Locking, Surface Mount

ARPA APS — ARPA APS
ARPA APS OL
Acuity Relay Panel accessory, Analog sensor, Outdoor

ETS 20DR — ETS2 20DR
RETS20 DR M20
Emergency Control Device, 0-10V Dimming Relays

n TCH — n TCH
NPOD TOUCH XX
Low Voltage Wallpod, Touchscreen Wall Control

n$ — n$
NPODMA XX
nLight Wired Aesthetic Wallpod

n$ 2PD — n$ 2PD
NPODMA 2P DX XX
nLight Wired Aesthetic Wallpod, 2-Pole, Raise/Lower Dimming Without Wires

n$ D — n$ D
NPODMA DX XX
nLight Wired Aesthetic Wallpod, Raise/Lower Dimming Without Wires

n$XP — n$XP
NWSXA PDT LV XX
Aesthetic Wall Switch Occupancy Sensor, Passive Dual Technology, Low Voltage

nCM ADC — nCM ADC
NCM ADCX
Low Voltage Ceiling Mount Sensor, Photocontrol w/ Auto Dimming; No Wires

nCP 10 — nCP 10
NCM PDT 10 RJB
Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Large Motion / Extended Range 360° Lens, Rear RJ-45 Ports

nCP 9 — nCP 9
NCM PDT 9 RJB
Low Voltage Ceiling Mount Sensor, Passive Dual Technology, Small Motion / Standard Range 360° Lens, Rear RJ-45 Ports

nP — nP
NPP16 EFP
Power/Relay Pack, External Fault Protection

nP ER — nP ER
NPP16 ER EFP
Power/Relay Pack, UL924 Emergency Operation, External Fault Protection

nP PL — nP PL
NPP20 PL
Plug Load

nPD — nPD
NPP16 D EFP
Power/Relay Pack, Occupancy Controlled Dimming, External Fault Protection

nPDER — nPD ER
NPP16 D ER EFP
Power/Relay Pack, Occupancy Controlled Dimming, UL924 Emergency Operation, External Fault Protection

nPS80 — nPS 80
NPS 80
Power Supply, 80 mA

PPSH — PP SH
PP16 SHUNT EFP
Bypass Relay Pack, Shunt

r$2PD — r$ 2PD
RPODBA 2P DX XX G2
nLight Preset Wall control, 2-Pole, Raise/Lower Dimming Without Wires, Generation Two

rCP10 — rCP 10
RCMS PDT 10 G2
Networked nLight AIR occupancy and daylight sensor, Passive Dual Technology, Large Motion / Extended Range 360° Lens, Generation Two

rPD24 — rPD 24
RPP20 D 24V EFP G2
nLight Air Power/Relay Pack, Networked Version, Dimming Side Output, 24 volt output, Generation Two

rPD24ER — rPD 24ER
RPP20 D 24V ER EFP G2
nLight Air Power/Relay Pack, Networked Version, Dimming Side Output, 24 volt output, UL924 Emergency Operation, Generation Two

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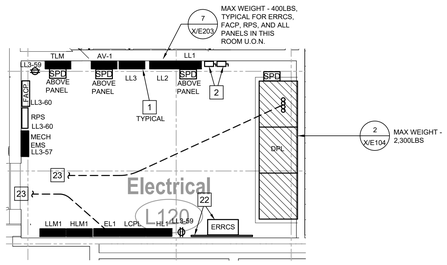
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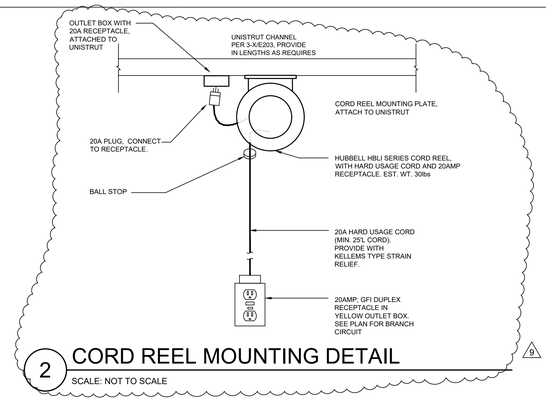
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1 ENLARGED PLAN AT ELECTRIC ROOM 120

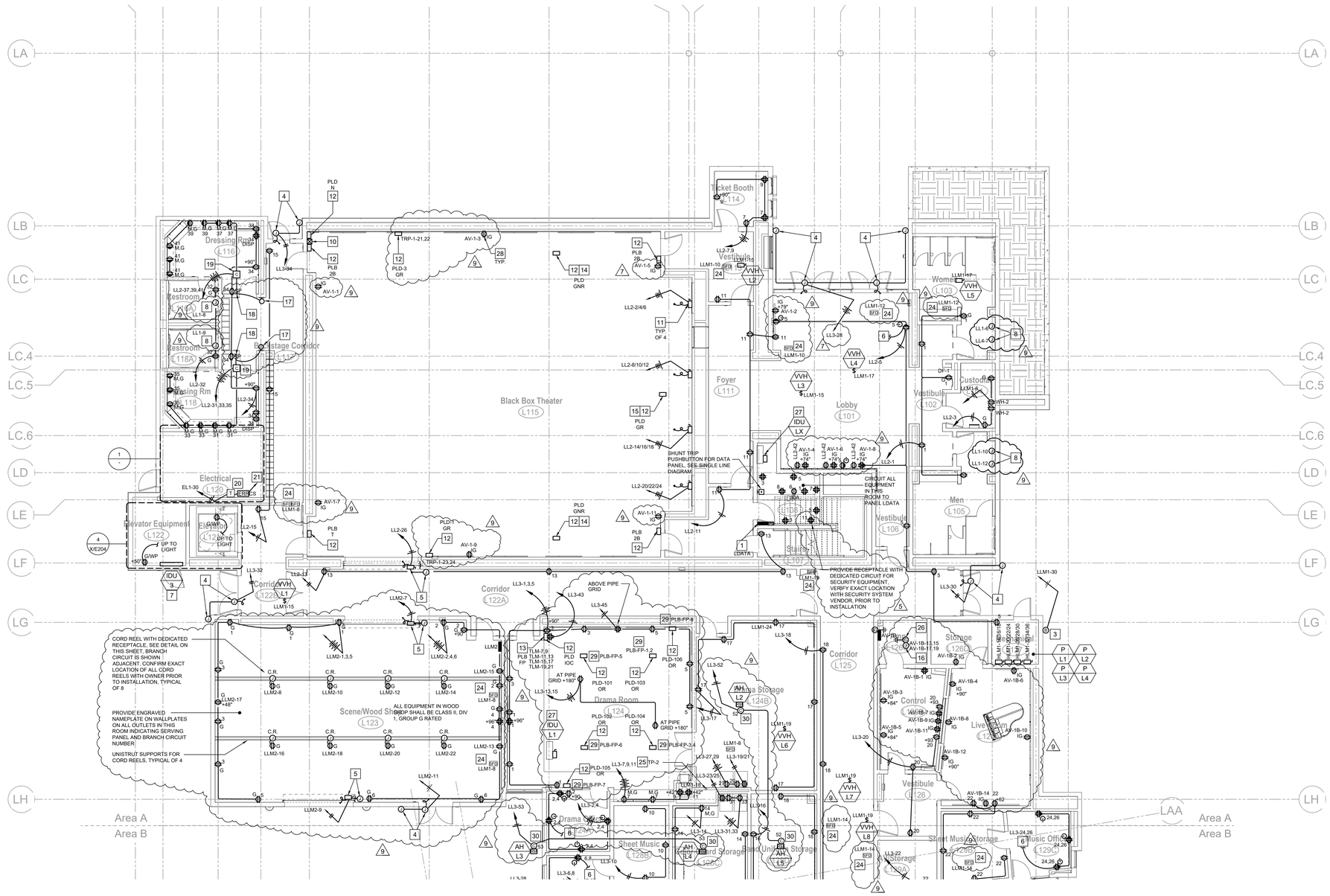
SCALE: 1/4"=1'-0"



2 CORD REEL MOUNTING DETAIL

SCALE: NOT TO SCALE

NOTE:
FOR CLARIFICATION, SOME HOMERUNS HAVE NOT BEEN SHOWN ON THIS SHEET. CONTRACTOR TO PROVIDE ALL REQUIRED HOMERUNS. REFER TO PANEL SCHEDULES FOR CONDUCTORS SIZES



BUILDING L FIRST FLOOR ELECTRICAL PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

General Notes

1. ELECTRICAL PANEL, SEE SINGLE LINE DIAGRAM AND REFER TO PANEL SCHEDULES.
2. LOCATIONS FOR FUTURE PHOTOVOLTAIC SYSTEM DISCONNECT SWITCHES.
3. PROVIDE 120V CONNECTION TO FIRE SPRINKLER BELL AS PER FIRE PROTECTION DRAWINGS.
4. PROVIDE 120V CONNECTION TO AUTOMATIC DOOR OPENER CONTROLLER AND LOW VOLTAGE CONTROLS ROUGH-IN AT INTERIOR AND EXTERIOR BOLLARDS (AS APPLICABLE) AS PER ARCHITECTURAL PLANS AND DOOR MANUFACTURERS RECOMMENDATIONS.
5. PROVIDE 120V CONNECTION TO AUTOMATIC DOOR OPENER AND ROUGH-IN FOR LOW VOLTAGE CONTROLS AND LOW VOLTAGE WIRING AS PER MANUFACTURER'S INSTRUCTIONS.
6. BRANCH CIRCUIT UP TO LIGHTING CONTROLS, SEE LIGHTING CONTROL PLANS.
7. PROVIDE LINE VOLTAGE CONNECTION TO INDOOR UNIT FROM CORRESPONDING OUTDOOR UNIT AS PER MECHANICAL PLANS.
8. PROVIDE CONNECTION TO ELECTRIC HAND DRYER PER HAND DRYER MANUFACTURERS RECOMMENDATIONS.
9. (1) 1-1/4" C.O. TO PANEL INDICATED.
10. MISCELLANEOUS POWER COMPANY SWITCH FURNISHED AND INSTALLED BY THE ELECTRICAL CONTRACTOR.
11. FIELD COORDINATE MOUNTING LOCATION WITH TELESCOPIC SEATING CONTRACTOR. TYPICAL OF 4.
12. PRODUCTION LIGHTING DEVICE. REFER TO PRODUCTION LIGHTING SHEETS FOR MORE INFORMATION.
13. PROVIDE (8) 20A ISOLATED GROUND DEDICATED CIRCUITS TO PRODUCTION LIGHTING PUSHBUTTON PANEL STATION. REFER TO PRODUCTION LIGHTING SHEETS FOR MORE INFORMATION.
14. MOUNT PRODUCTION LIGHTING DEVICE TO UNDERSIDE OF CATWALK.
15. MOUNT PRODUCTION LIGHTING DEVICE TO PIPE BELOW CONTROL BOOTH WINDOW.
16. PROVIDE (4) 20A ISOLATED GROUND DEDICATED CIRCUITS TO AV EQUIPMENT RACKS. CONNECT RACEWAY USING NON-CONDUCTIVE CONDUIT TO MAINTAIN ISOLATED GROUND.
17. STEADY-ON LEO RED PILOT LIGHT. MOUNT ADJACENT TO DOOR. LIGHT TO INDICATE WHEN RECEPTACLES AND LIGHTING ABOVE DRESSING ROOM COUNTERS ARE ENERGIZED, VERIFY EXACT LOCATION WITH ARCHITECT PRIOR TO INSTALLATION.
18. SWITCH FOR CONTROL OF RECEPTACLES AND LIGHTING ABOVE DRESSING ROOM COUNTER.
19. 6 POLE DRESSING ROOM CONTROLS CONTACTOR FOR CONTROL OF ABOVE COUNTER RECEPTACLES COUNTER AND 'DR' TYPE FIXTURE LIGHTING BRANCH CIRCUITS, MOUNT IN NEMA 1 ENCLOSURE IN ACCESSIBLE CEILING SPACE.
20. PROVIDE 500VA, 277-120V TRANSFORMER IN NEMA 1 ENCLOSURE HIGH ON WALL FOR ERRC SYSTEM EQUIPMENT POWER.
21. 3" GRS CONDUIT TO ROOF AND BETWEEN FLOORS FOR ERRCS CABLING. REFER TO ARCHITECTURAL PLANS 2-HR RATED PATHWAY LOCATIONS.
22. EMERGENCY RESPONDER RADIO COVERAGE SYSTEM EQUIPMENT (ERRCS), REFER TO SPECIFICATIONS, PROVIDE 3/4" THICK FIRE RATED 4' X 8' PLYWOOD BKBD BEHIND ERRCS EQUIPMENT.
23. UNDERGROUND POWER DISTRIBUTION SYSTEM FEEDER, SEE SINGLE LINE DIAGRAM AND SITE ELECTRICAL PLANS.
24. PROVIDE 120V CONNECTION TO SMOKE FIRE DAMPER AS PER MECHANICAL PLANS.
25. PROVIDE 120V CONNECTION TO MOTORIZED TRAP PRIMER AS PER PLUMBING PLANS.
26. PROVIDE #3/0 AWG CABLE FOR CONNECTION TO AV EQUIPMENT RACKS TO ISOLATED GROUND, AS PER AV DRAWINGS, BRING INTO RACK USING NON-CONDUCTIVE CONDUIT TO COPPER IG BUS.
27. PROVIDE LINE VOLTAGE FROM INDOOR UNIT TO CORRESPONDING OUTDOOR UNIT AS PER MECHANICAL PLANS.
28. REFER TO PRODUCTION LIGHTING DRAWINGS FOR SPECIFIC REQUIREMENTS FOR ALL "IG" TYPE RECEPTACLES.
29. DEDICATED CIRCUIT(S), RUN TO PRODUCTION RELAY PANEL STATION.
30. CONTACTOR FOR HVAC UNIT SHUTDOWN, SEE 3-X/E503.

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EXPIRES: 06/30/25
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DSA File No.:
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Architect

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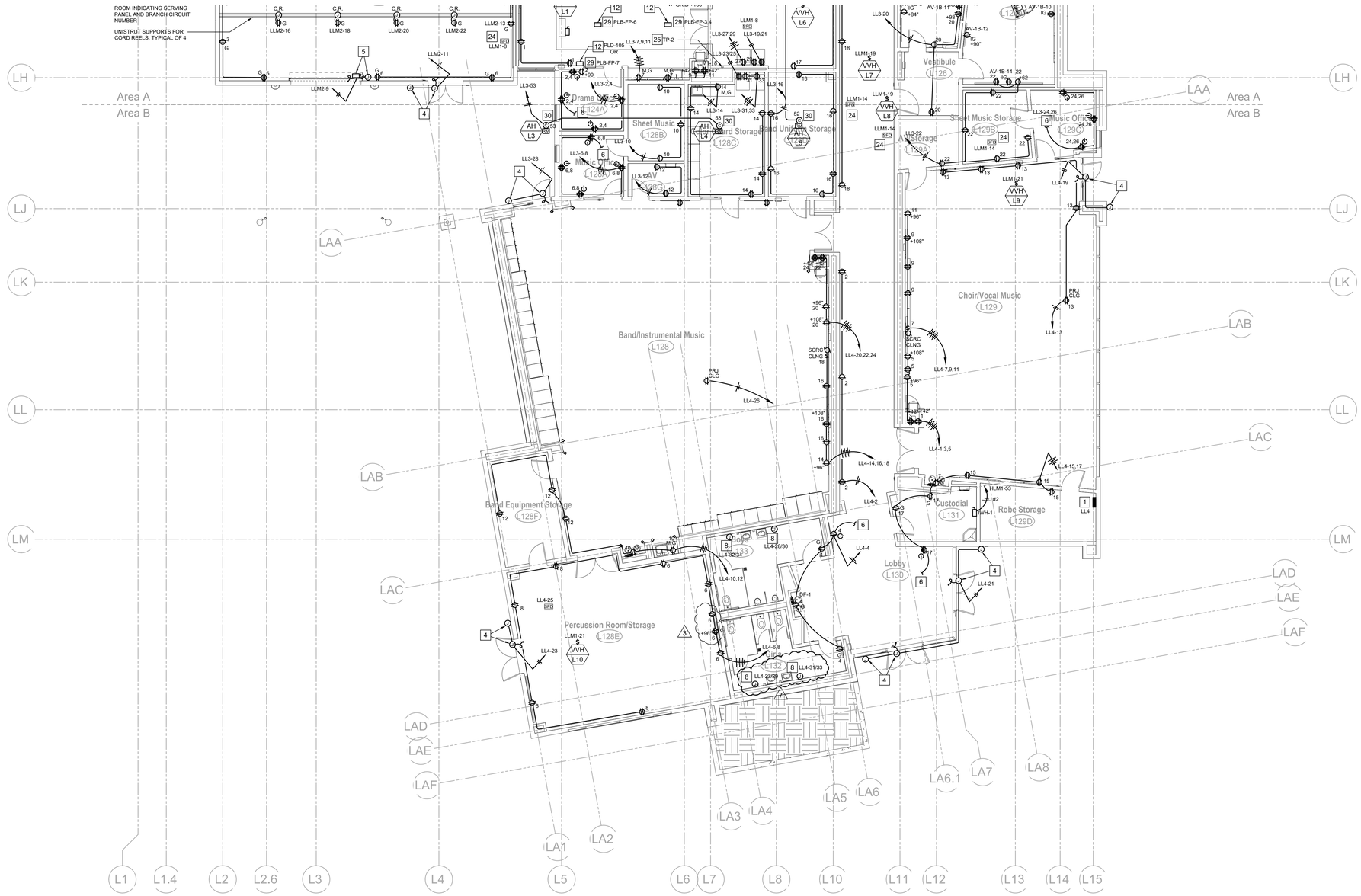
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BUILDING L FIRST FLOOR ELECTRICAL PLAN AREA B

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
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2. LOCATIONS FOR FUTURE PHOTOVOLTAIC SYSTEM DISCONNECT SWITCHES.
3. PROVIDE 120V CONNECTION TO FIRE SPRINKLER BELL AS PER FIRE PROTECTION DRAWINGS.
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5. PROVIDE 120V CONNECTION TO AUTOMATIC DOOR OPENER AND ROUGH-IN FOR LOW VOLTAGE CONTROLS AND LOW VOLTAGE WIRING AS PER MANUFACTURER'S INSTRUCTIONS.
6. BRANCH CIRCUIT UP TO LIGHTING CONTROLS, SEE LIGHTING CONTROL PLANS.
7. NOT USED.
8. PROVIDE CONNECTION TO ELECTRIC HAND DRYER PER HAND DRYER MANUFACTURERS RECOMMENDATIONS.
9. (1) 1-1/4" C.O. TO PANEL INDICATED.
10. REFER TO PRODUCTION LIGHTING DRAWINGS FOR SPECIFIC REQUIREMENTS FOR ALL "IG" TYPE RECEPTACLES.

General Notes

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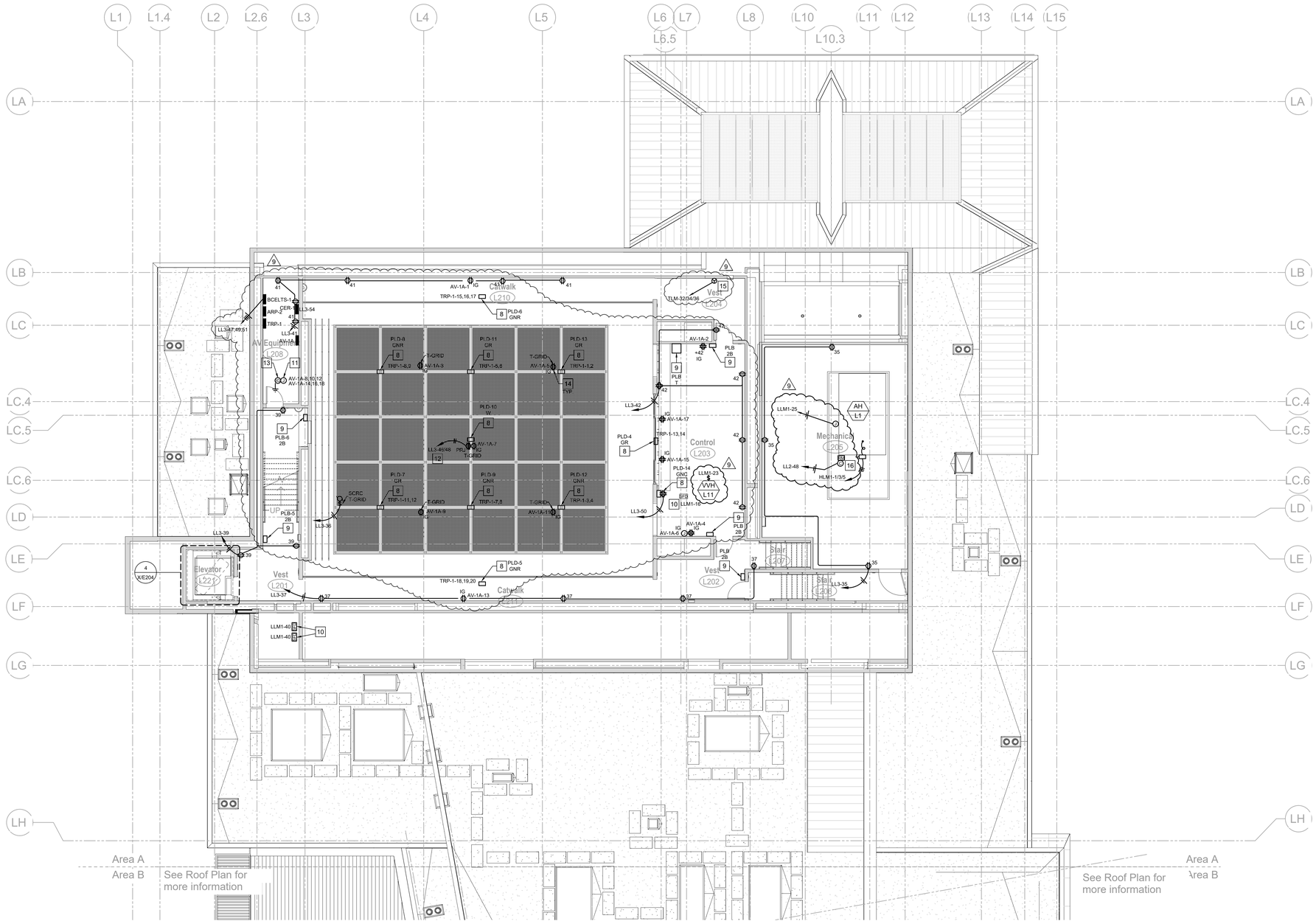
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BUILDING L SECOND FLOOR ELECTRICAL PLAN AREA A

SCALE: 1/8"=1'-0"

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3. PROVIDE 120V CONNECTION TO FIRE SPRINKLER BELL AS PER FIRE PROTECTION DRAWINGS.
4. PROVIDE 120V CONNECTION TO AUTOMATIC DOOR OPENER CONTROLLER AND LOW VOLTAGE CONTROLS ROUGH-IN AT BOLLARD (AS APPLICABLE) AS PER ARCHITECTURAL PLANS AND DOOR MANUFACTURERS RECOMMENDATIONS.
5. PROVIDE 120V CONNECTION TO AUTOMATIC DOOR OPENER AND ROUGH-IN FOR LOW VOLTAGE CONTROLS AND LOW VOLTAGE WIRING AS PER MANUFACTURER'S INSTRUCTIONS.
6. BRANCH CIRCUIT UP TO LIGHTING CONTROLS, SEE LIGHTING CONTROL PLANS.
7. NOT USED.
8. PRODUCTION LIGHTING DEVICE REFER TO PRODUCTION LIGHTING SHEETS FOR MORE INFORMATION.
9. PRODUCTION LIGHTING PUSHBUTTON DEVICE REFER TO PRODUCTION LIGHTING SHEETS FOR MORE INFORMATION.
10. PROVIDE 120V CONNECTION TO SMOKE FIRE DAMPER AS PER MECHANICAL PLANS.
11. PROVIDE (6) 20A ISOLATED GROUND DEDICATED CIRCUITS TO AV EQUIPMENT RACKS. CONNECT RACEWAY USING NON-CONDUCTIVE CONDUIT TO MAINTAIN ISOLATED GROUND.
12. PROVIDE (1) DEDICATED 208V 30A L6-30R CONFIGURATION FOR VIDEO PROJECTOR.
13. PROVIDE #3/0 AWG CABLE FOR CONNECTION TO AV EQUIPMENT RACKS TO ISOLATED GROUND. BRING INTO RACK USING NON-CONDUCTIVE CONDUIT TO COPPER IG BUS.
14. REFER TO PRODUCTION LIGHTING DRAWINGS FOR SPECIFIC REQUIREMENTS FOR ALL "IG" TYPE RECEPTACLES.
15. POWER COMPANY SWITCH FURNISHED AND INSTALLED BY THE ELECTRICAL CONTRACTOR, REFER TO SPECIFICATION SECTION 260535 FOR SWITCH INFORMATION.
16. CONTACTOR FOR HVAC UNIT SHUTDOWN, SEE 3-X/E503.

General Notes

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Consultant THOMA #22-8060

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1760 S Fowler Ave, Fresno CA 93727

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LICENSED ARCHITECT
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No. C23724
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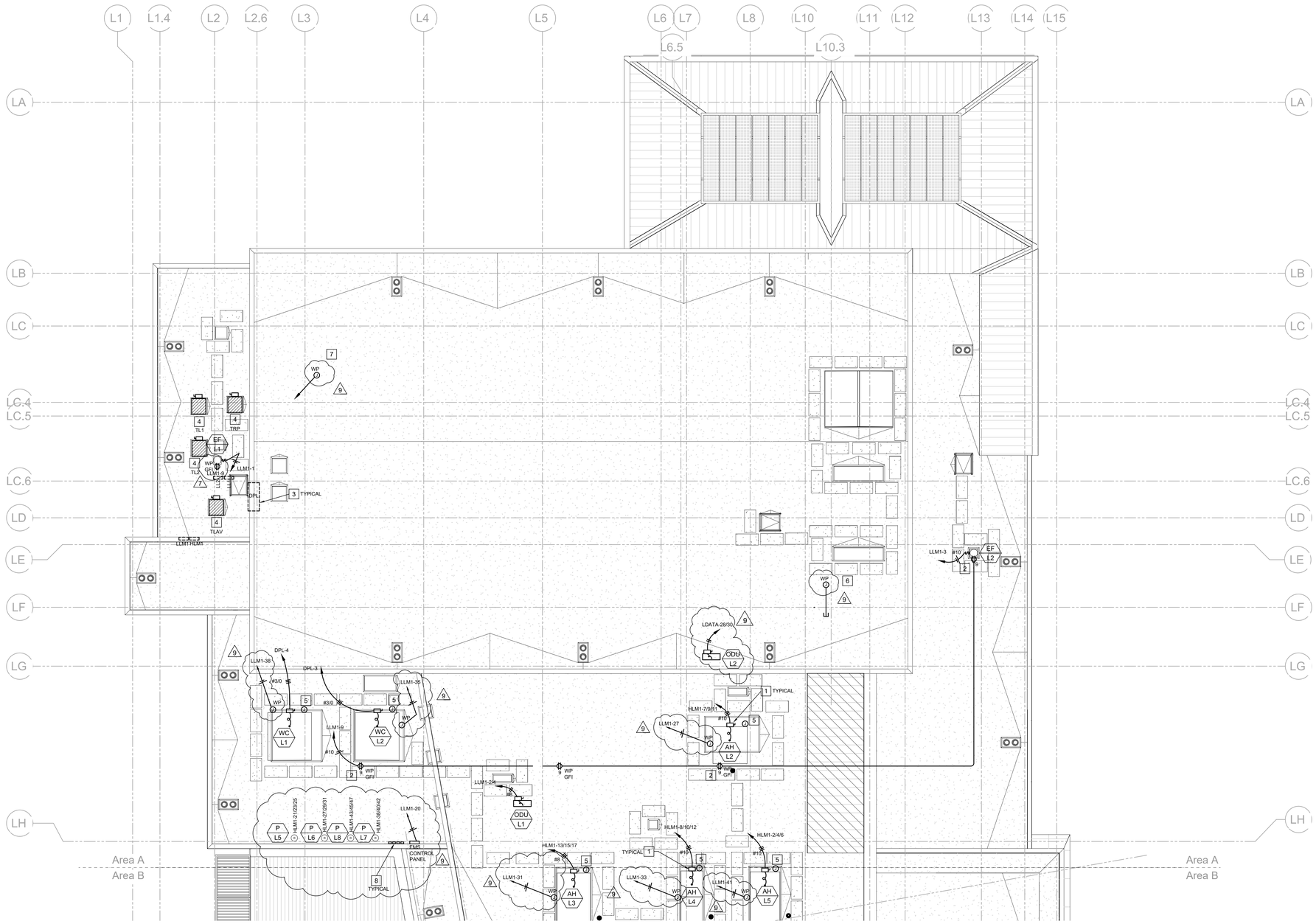
Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

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Project Number: 2171	Checked By:	AD10
Date: 08/27/24	Reviewed By:	

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NOTE:
FOR CLARIFICATION, SOME HOMERUNS HAVE NOT BEEN SHOWN ON THIS SHEET. CONTRACTOR TO PROVIDE ALL REQUIRED HOMERUNS. REFER TO PANEL SCHEDULES FOR CONDUCTORS SIZES.

BUILDING L ROOF ELECTRICAL PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

1. WP FUSIBLE DISCONNECT SWITCH WITH FLEXIBLE CONNECTION TO HVAC UNIT. FUSE DISCONNECT SWITCH PER HVAC UNIT NAMEPLATE RATINGS.
2. WP GFI RECEPTACLE WITH CAST ALUMINUM WIU (WHILE IN USE) COVER, MOUNT ON SIDE OF HVAC UNIT CURB.
3. APPROXIMATE LOCATION OF ELECTRICAL PANEL IN ELECTRICAL ROOM BELOW.
4. STEP DOWN TRANSFORMER WITH DISCONNECT SWITCH ADJACENT, SEE SINGLE LINE DIAGRAM.
5. WP JUNCTION BOX WITH (1) 3/4" C.O. STUB THROUGH ROOF FOR LOW VOLTAGE CONTROL WIRING BY OTHERS.
6. PROVIDE (2) 2" C.O. STUBS THROUGH ROOF TO DATA ROOM.
7. (1) 2" C.O. STUB FOR FUTURE PV SYSTEM TO FUTURE DISCONNECT SWITCH LOCATION, SEE SINGLE LINE DIAGRAM. STUB CONDUIT BELOW ROOF FOR FUTURE EXTENSION TO PV SYSTEM.
8. VFD WITH FLEXIBLE CONNECTION TO PUMP, VERIFY PUMP EXACT LOCATION WITH MECHANICAL PLANS, REFER TO MECHANICAL PLANS FOR VFD INFORMATION.

△9

General Notes

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Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

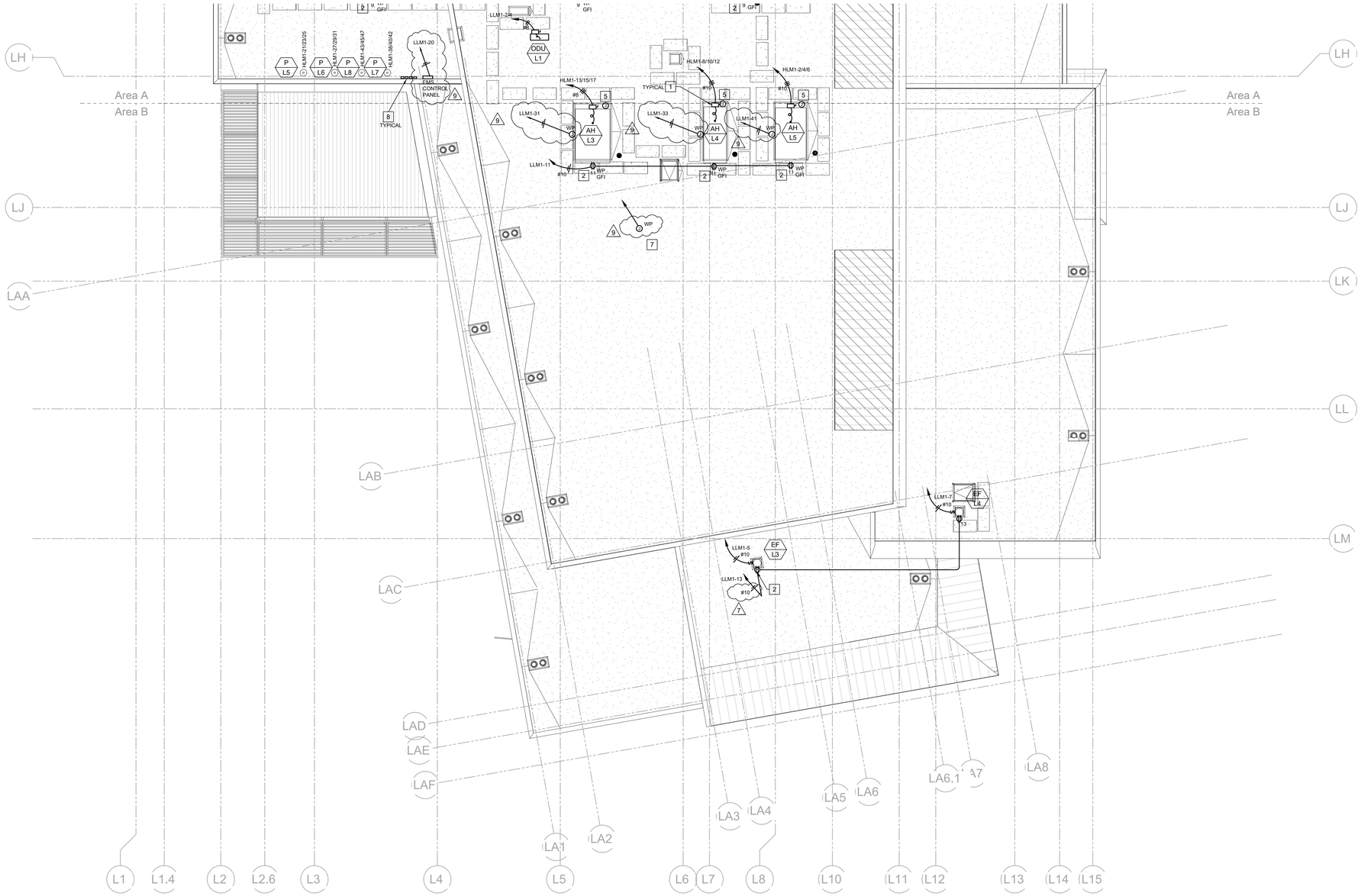
Revision

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Scale: As indicated	Drawn By:
Project Number: 2171	Checked By:
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NOTE:
FOR CLARIFICATION, SOME HOMERUNS HAVE NOT BEEN SHOWN ON THIS SHEET. CONTRACTOR TO PROVIDE ALL REQUIRED HOMERUNS. REFER TO PANEL SCHEDULES FOR CONDUCTORS SIZES

BUILDING L ROOF ELECTRICAL PLAN AREA B

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
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☐ Sheet Reference Notes

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General Notes

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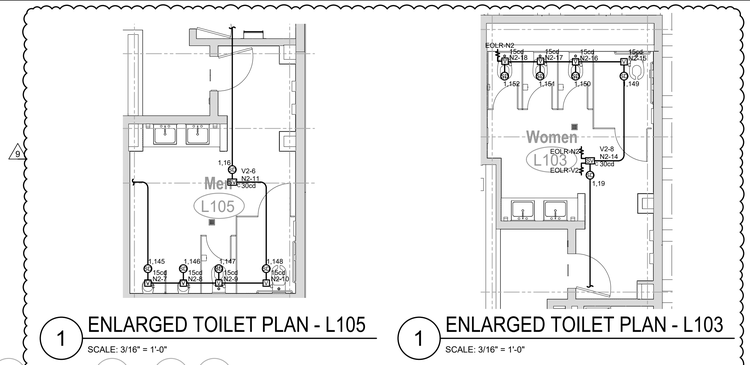
LICENSED ARCHITECT MICHAEL K. FENNO No. C23724 REN. 4-30-27 STATE OF CALIFORNIA
Architect

No.	Revision/Submission	Date
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Revision

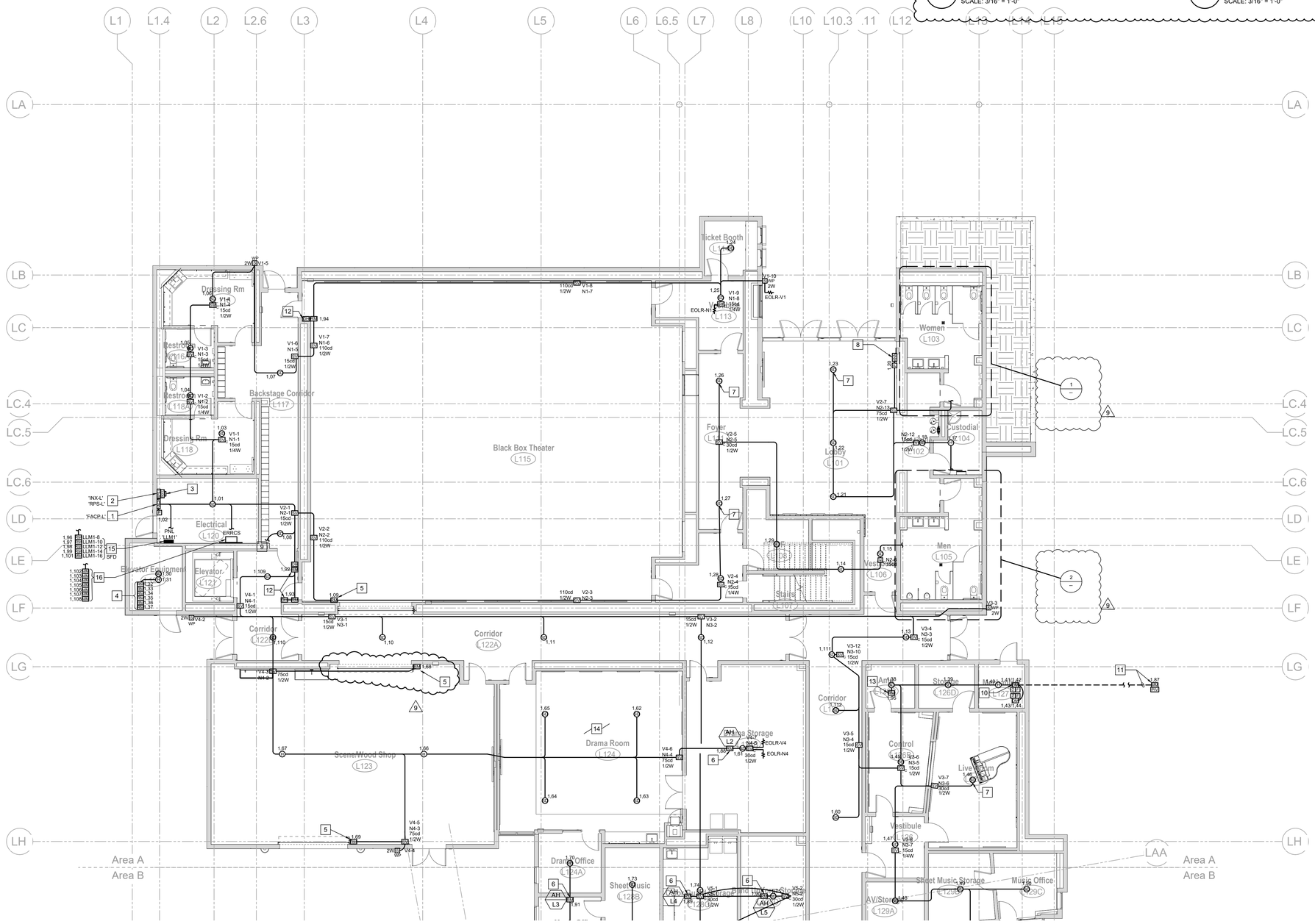
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1 ENLARGED TOILET PLAN - L105
SCALE: 3/16" = 1'-0"

1 ENLARGED TOILET PLAN - L103
SCALE: 3/16" = 1'-0"



BUILDING L FIRST FLOOR FIRE ALARM PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
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Agency Approval

Sheet Reference Notes

(SAME AS ON SHEET LFA202.4)

1. FIRE ALARM VOICE EVAC CONTROL PANEL (FACP-L). SEE FIRE ALARM RISER DIAGRAM SHEET X/E500.
2. FIRE ALARM INX-L AND RPS-L PANEL. SEE FIRE ALARM RISER DIAGRAM, SHEET X/E500.
3. FIRE ALARM DOCUMENTATION CABINET. LABEL CABINET, "SYSTEM RECORD DOCUMENTS".
4. PROVIDE FIRE ALARM RELAY MODULES FOR ELEVATOR RECALL. SEE DETAIL 4-X/E204.
5. PROVIDE FIRE ALARM RELAY MODULE AT FIRE RATED ROLL-UP DOOR TO CLOSE DOOR UPON ACTIVATION OF THE FIRE ALARM SYSTEM, SEE DETAIL 13-X/E503. FIELD VERIFY EXACT LOCATION.
6. PROVIDE FIRE ALARM RELAY MODULE AT HVAC UNIT TO SHUTDOWN UNIT UPON ACTIVATION OF THE FIRE ALARM SYSTEM, SEE DETAIL 3-X/E503. FIELD VERIFY EXACT LOCATION.
7. MOUNT SMOKE DETECTOR ABOVE MOLDED REFLECTORS ACOUSTIC PANELS. FIELD VERIFY EXACT LOCATION.
8. FIRE ALARM REMOTE FIRE ALARM ANNUNCIATOR.
9. CONTINUE ON SECOND FLOOR, SHEET L/FA203.4.
10. PROVIDE FIRE ALARM DUAL MONITOR MODULE AT FIRE SPRINKLER SYSTEM TAMPER FLOW SWITCH. SEE DETAIL 9-X/E503. FIELD VERIFY EXACT LOCATION.
11. PROVIDE FIRE ALARM MONITOR MODULE AT FIRE SPRINKLER P.I.V. SEE DETAIL 9-X/E503. FIELD VERIFY EXACT LOCATION.
12. INTERCEPT DOOR HOLDER 24V AUX POWER CIRCUIT WITH FIRE ALARM SYSTEM RELAY MODULE AS SHOWN, DOOR HOLDER TO RELEASE UPON SIGNAL FROM FIRE ALARM SYSTEM. SEE DETAIL 12-X/E503. FIELD VERIFY EXACT LOCATION.
13. PROVIDE FIRE ALARM RELAY MODULE AT PRODUCTION LIGHTING/AV EQUIPMENT TO OVERRIDE CONTROLS TO RESTORE HOUSE LIGHTING AND SOUND TO NORMAL UPON ACTIVATION OF THE FIRE ALARM SYSTEM. FIELD VERIFY EXACT LOCATION. COORDINATE CONNECTION WITH PRODUCTION LIGHTING/AV VENDOR.
14. DETECTORS TO BE MOUNTED TO UNDERSIDE OF ROOF STRUCTURE ABOVE LIGHTING GRID SYSTEM.
15. INTERCEPT SMOKE FIRE DAMPER 120V BRANCH CIRCUIT AS SHOWN WITH FIRE ALARM SYSTEM RELAY MODULE AS SHOWN, DAMPER TO CLOSE UPON SIGNAL FROM FIRE ALARM SYSTEM. SEE DETAIL 11-X/E503 FOR ADDITIONAL INFORMATION.
16. PROVIDE FIRE ALARM MONITOR MODULES AT EMERGENCY RADIO COMMUNICATIONS SYSTEM. FIELD VERIFY LOCATION AND COORDINATE WITH VENDOR. SEE FIRE ALARM RISER DIAGRAM SHEET X/E500 FOR ADDITIONAL INFORMATION.

9 CONDUIT QUANTITIES AND RUNS SHOWN ON THIS PLAN ARE SCHEMATIC ONLY, PROVIDE SEPARATE DEDICATED CONDUITS FOR SIGNALING DEVICES AND INITIATING DEVICES, REFER TO FIRE ALARM RISER DIAGRAM FOR QUANTITY AND SIZES OF CONDUITS TO BE PROVIDED TO SUPPORT THE FIRE ALARM SYSTEM.

General Notes

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Architect

No.	Revision/Submission	Date
13	RFP 13	08/27/24
28	CCD #28	02/20/25
9	DSA ADDENDUM 10	10/02/26

Revision

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Project Number: 2171	Checked By:	
Date: 08/27/24	Reviewed By:	

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1 ENLARGED TOILET PLAN - L132, L133

SCALE: 3/16" = 1'-0"

BUILDING L FIRST FLOOR FIRE ALARM PLAN AREA B

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

Sheet Reference Notes

(SAME AS ON SHEET LFA201.4)

1. FIRE ALARM VOICE EVAC CONTROL PANEL (FACP-L). SEE FIRE ALARM RISER DIAGRAM SHEET X/E500.
2. FIRE ALARM INX-L AND RPS-L PANEL. SEE FIRE ALARM RISER DIAGRAM, SHEET X/E500.
3. FIRE ALARM DOCUMENTATION CABINET. LABEL CABINET, "SYSTEM RECORD DOCUMENTS".
4. PROVIDE FIRE ALARM RELAY MODULES FOR ELEVATOR RECALL. SEE DETAIL 4-X/E204.
5. PROVIDE FIRE ALARM RELAY MODULE AT FIRE RATED ROLL-UP DOOR TO CLOSE DOOR UPON ACTIVATION OF THE FIRE ALARM SYSTEM, SEE DETAIL 13-X/E503. FIELD VERIFY EXACT LOCATION.
6. PROVIDE FIRE ALARM RELAY MODULE AT HVAC UNIT TO SHUTDOWN UNIT UPON ACTIVATION OF THE FIRE ALARM SYSTEM, SEE DETAIL 3-X/E503. FIELD VERIFY EXACT LOCATION.
7. MOUNT SMOKE DETECTOR ABOVE MOLDED REFLECTORS ACOUSTIC PANELS. FIELD VERIFY EXACT LOCATION.
8. FIRE ALARM REMOTE FIRE ALARM ANNUNCIATOR.
9. CONTINUE ON SECOND FLOOR, SHEET L/FA203.4.
10. PROVIDE FIRE ALARM DUAL MONITOR MODULE AT FIRE SPRINKLER SYSTEM TAMPER FLOW SWITCH. SEE DETAIL 9-X/E503. FIELD VERIFY EXACT LOCATION.
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14. DETECTORS TO BE MOUNTED TO UNDERSIDE OF ROOF STRUCTURE ABOVE LIGHTING GRID SYSTEM.
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9 CONDUIT QUANTITIES AND RUNS SHOWN ON THIS PLAN ARE SCHEMATIC ONLY, PROVIDE SEPARATE DEDICATED CONDUITS FOR SIGNALING DEVICES AND INITIATING DEVICES, REFER TO FIRE ALARM RISER DIAGRAM FOR QUANTITY AND SIZES OF CONDUITS TO BE PROVIDED TO SUPPORT THE FIRE ALARM SYSTEM.

General Notes

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Revision

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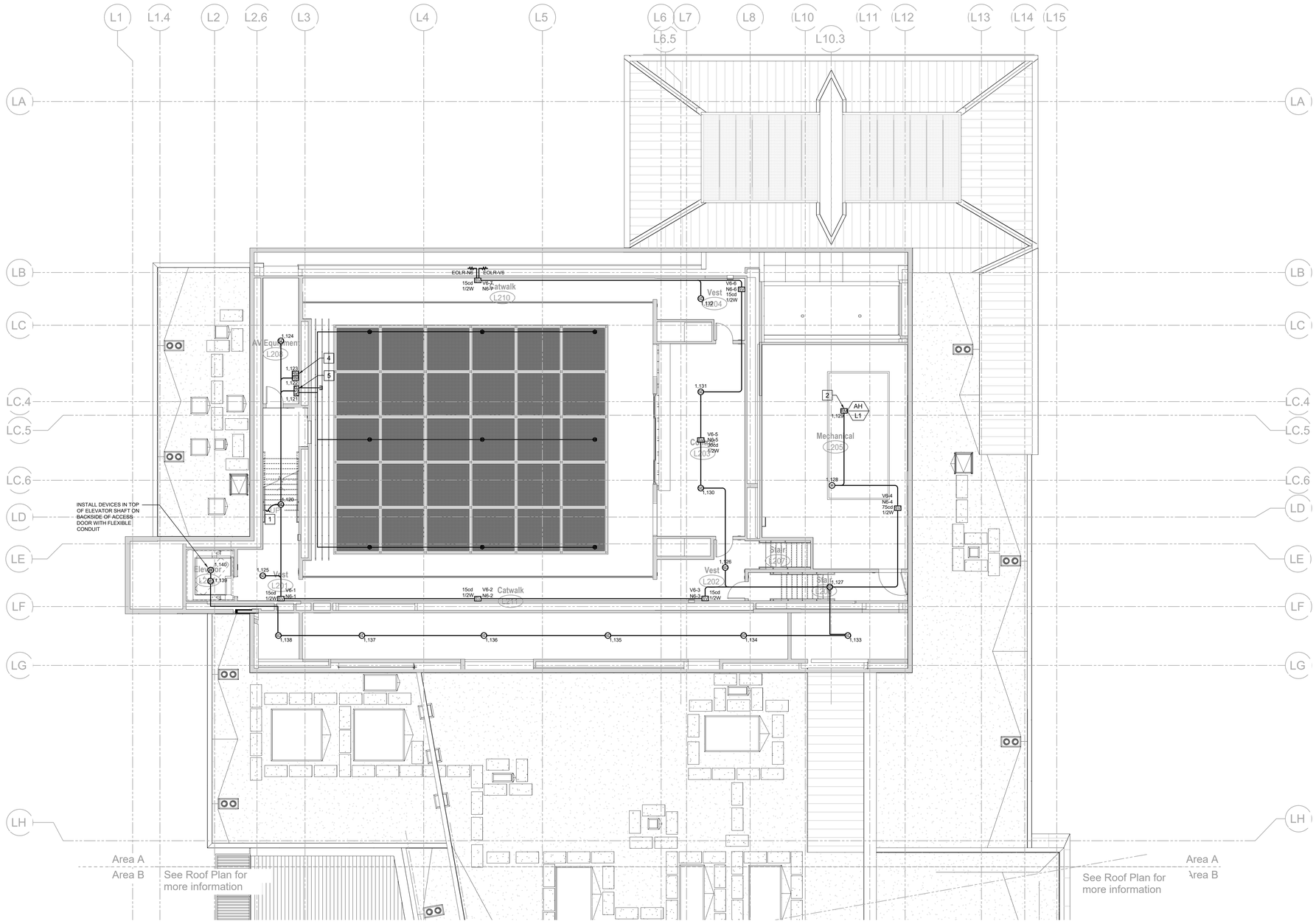
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Date: 08/27/24
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BUILDING L SECOND FLOOR FIRE ALARM PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

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DSA File

DSA Application No.:
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Sheet Reference Notes

(SAME AS ON SHEET LFA204)

1. CONTINUE ON FIRST FLOOR, SHEET L/FA201.4.
2. PROVIDE FIRE ALARM RELAY MODULE AT HVAC UNIT TO SHUTDOWN UNIT UPON ACTIVATION OF THE FIRE ALARM SYSTEM, SEE DETAIL 3-X/ES03. FIELD VERIFY EXACT LOCATION.
3. INTERCEPT SMOKE FIRE DAMPER 120V BRANCH CIRCUIT AS SHOWN WITH FIRE ALARM SYSTEM RELAY MODULE AS SHOWN TO CLOSE DAMPER UPON FIRE ALARM SYSTEM ACTIVATION. SEE DETAIL 11-X/E503.
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EXPIRES: 06/30/25

Consultant THOMA #22-8060

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LICENSED ARCHITECT JEFFREY K. FERRIS No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

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9	DSA ADDENDUM 10	10/02/26

Revision

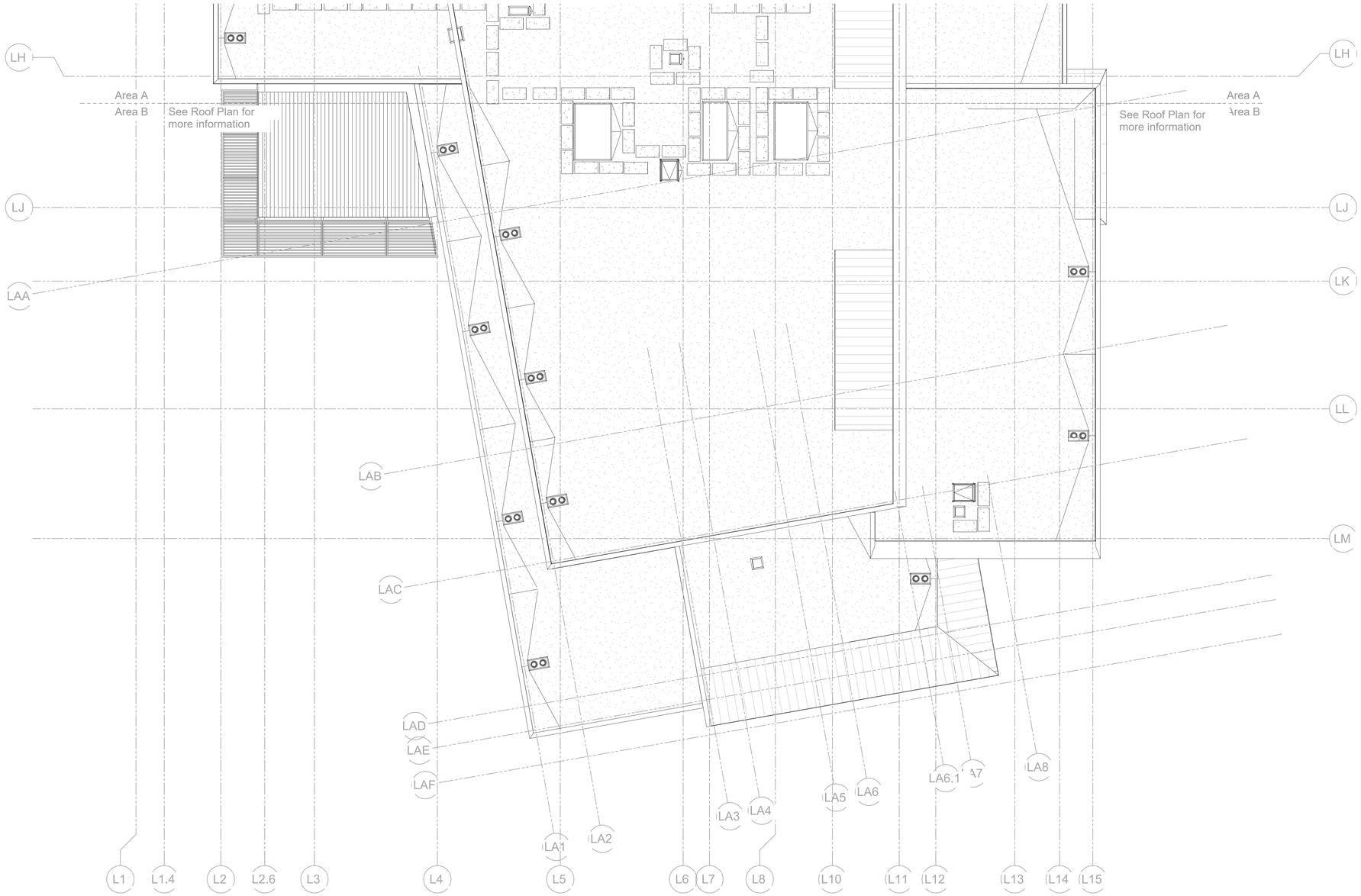
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BUILDING L SECOND FLOOR FIRE ALARM PLAN AREA B

SCALE: 1/8"=1'-0"

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Sheet Reference Notes

(SAME AS ON SHEET LFA203)

1. CONTINUE ON FIRST FLOOR, SHEET L/FA201.4.
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EXPIRES: 06/30/25

Consultant THOMA #22-8060

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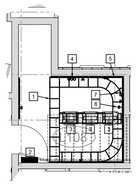
LICENSED ARCHITECT MICHAEL K. FENNO No. C23724 REN. 4-30-27 STATE OF CALIFORNIA

Architect

No.	Revision/Submission	Date
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9	DSA ADDENDUM 10	10/02/26

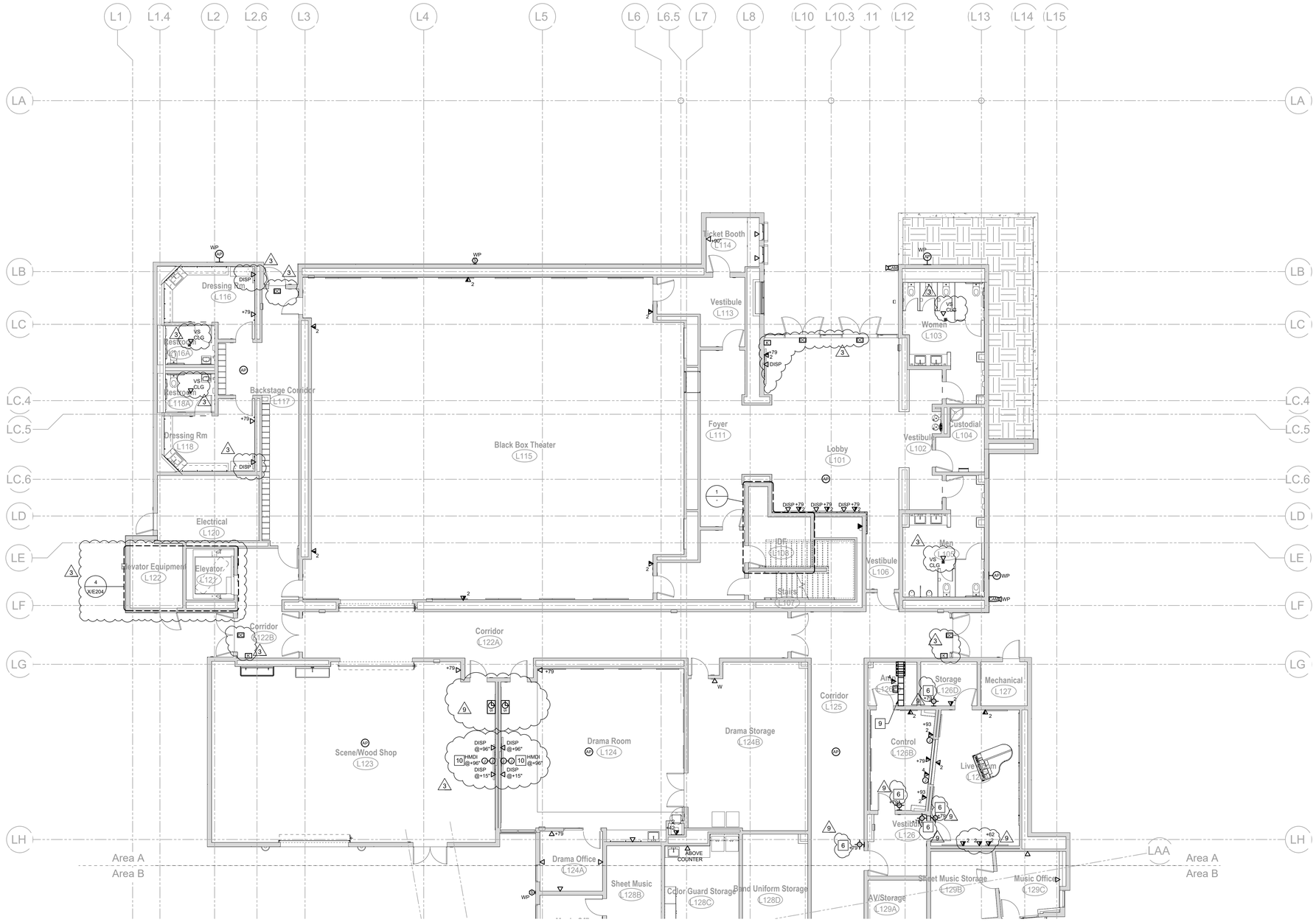
Revision

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Project Number: 2171	Checked By:	*L/FA204.4*
Date: 08/27/24	Reviewed By:	AD10



1 ENLARGED PLAN AT IDF 108

SCALE: 1/4"=1'-0"



BUILDING L FIRST FLOOR COMMUNICATIONS PLAN AREA A

SCALE: 1/8"=1'-0"

NORTH

DSA File No.:
DSA File

DSA Application No.:
DSA App

Agency Approval

☐ Sheet Reference Notes

1. CHATSWORTH 12" WIDE UNIVERSAL CABLE RUNAWAY (10250-X12 SERIES OR APPROVED EQUIVALENT) PER STANDARD PROJECT DETAILS AND SPECIFICATIONS. REFER TO DETAIL 4/X/T207 FOR MOUNTING REQUIREMENTS. EC SHALL PROVIDE JUNCTION SPLICES, RACK TO RUNWAY MOUNTING PLATE, AND WALL ANGLE SUPPORT KITS. EC SHALL USE #6 AWG CONDUCTOR AND MANUFACTURER APPROVED MECHANICAL BONDING CONNECTORS BETWEEN ALL SEGMENTS OF CABLE-TRAY AND CABLE-TRAY ACCESSORIES. 45 DEGREE RUNWAY SPLICE KITS WILL BE REQUIRED TO MEET CONDUIT SLEEVES ABOVE ADJACENT CEILING SPACE. CABLE RUNWAY SHALL BE ATTACHED TO THE TOP OF DATA RACKS AND MOUNTED AT SAME HEIGHT THROUGHOUT ROOM. CONTRACTOR SHALL COORDINATE TRANSITION HEIGHTS IN THE FIELD.
2. DATA ROOM ELECTRICAL PANEL, SHOWN FOR REFERENCE, REFER TO ELECTRICAL DRAWINGS FOR INFORMATION.
3. 2-POST EQUIPMENT RACKS PER PLAN WITH VERTICAL AND HORIZONTAL WIRE MANAGEMENT PER DETAIL 1/X/T203. MAINTAIN 36" CLEARANCE FRONT AND BACK AS SHOWN. SEE 3/X/T207 FOR ANCHORAGE. RACK MAXIMUM WEIGHT = 400LBS.
4. TELECOMMUNICATIONS UTILITY CONDUIT ENTRANCE TO BUILDING. SEE ELECTRICAL SITE PLAN SD/T106.
5. PROVIDE 3/4" THICK FIRE RATED PLYWOOD BACKBOARD (PAINTED FLAT WHITE) ON ALL FOUR WALLS PER PLAN, STACKED HORIZONTALLY, (2) HIGH, STARTING 6" AFF.
6. RECORDING LIGHT. CONTRACTOR SHALL PROVIDE 2-GANG DOUBLE-DEPTH BOX WITH BELDEN-9740 HOMERUN TO AV RACK.
7. PHONE CABLE CONDUIT ENTRANCE. SURGE PROTECTION AND 110 STYLE PUNCH BLOCKS FOR MOUNTED TO FIRE RATED BACKBOARD. ALL INCOMING PAIRS SHALL BE PROTECTED AND TERMINATED.
8. TELECOMMUNICATIONS GROUND BUS BAR ('TGB'). REFER TO ELECTRICAL. PROVIDE #6 AWG CONDUCTOR BETWEEN ALL SEGMENTS OF CABLE TRAY IN ROOM BACK TO 'TMGB' USING MANUFACTURER'S APPROVED GROUNDING MEANS. SEE 6/X/T206.
9. OVERHEAD CABLE TRAY FOR ROUTING OF LOW VOLTAGE AV CABLES. 3 DIVIDERS FOR 4 COMPARTMENTS B-LINE SERIES 1 OR EQUAL.
10. TRUE 5" SQUARE FLUSH MOUNTED BACKBOX WITH 1 GANG RING AND FEMALE HDMI CONNECTOR, PROVIDE (1) 1-1/4" CONDUIT BETWEEN HDMI PASSTHRU BOXES ABOVE AND BELOW MONITOR. PROVIDE AND INSTALL HDMI CABLE BETWEEN BACKBOXES AND HDMI CONNECTOR.

COORDINATION MEETING WITH DISTRICT

- PRIOR TO THE INSTALLATION OF THE PATHWAY, AND AFTER THE METAL FRAMING IS NEAR COMPLETE, HOLD A SET OF MEETINGS AND REVIEW THE FOLLOWING SYSTEMS.
- CAMERA LOCATIONS, WALL MOUNT AND CEILING LOCATIONS.
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- WALL MOUNTED PHONE LOCATIONS.
- WIRELESS ACCESS POINTS (AP) ROUGH IN LOCATIONS.
- VAPE SENSORS (VS) ROUGH IN LOCATIONS IN STUDENT RESTROOMS.
- CLOCK SPEAKER ROUGH IN LOCATIONS.

GENERAL NOTES

A. ALL CATEGORY CABLING SHOWN SHALL BE SERVED BY IDF 108 UNLESS NOTED OTHERWISE.

B. PROVIDE PRIMARY J-HOOK PATHWAYS IN CORRIDORS WITH MINIMUM 50% SPARE CAPACITY FOR FUTURE CABLING.

C. REFER TO TELECOMMUNICATIONS DEVICE CABLING SCHEDULE ON SHEET X/T201 FOR ROUGH-IN, CABLING, FACEPLATE AND ADDITIONAL INFORMATION.

D. DEVICE LOCATIONS SHOWN ARE SCHEMATIC AND APPROXIMATE. EXACT LOCATIONS SHALL BE FIELD VERIFIED DURING ROUGH-IN WITH ARCHITECTURAL ELEVATIONS, CASEWORK SHOP DRAWINGS, FURNITURE, ETC. AND SHALL BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICT WITH OTHER EQUIPMENT.

E. ELECTRICAL AND COMMUNICATIONS OUTLETS SHOWN IN THE SAME LOCATION, SHALL BE MOUNTED ON OPPOSITE SIDES OF THE SAME STUD. COORDINATE BETWEEN ELECTRICAL AND COMMUNICATIONS PLANS.

General Notes

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REGISTERED PROFESSIONAL ENGINEER WILLIAM A. THOMA ELECTRICAL STATE OF CALIFORNIA
EXPIRES: 06/30/25

Consultant THOMA #22-8060

SANGER EDUCATION COMPLEX-PHASE 3

Sanger Unified School District
1760 S Fowler Ave, Fresno CA 93727

Project

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LICENSED ARCHITECT RICHARD K. FERNOD No. C23724 Exp. 4-30-27 STATE OF CALIFORNIA

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BUILDING L FIRST FLOOR COMMUNICATIONS PLAN AREA B

SCALE: 1/8"=1'-0"

NORTH

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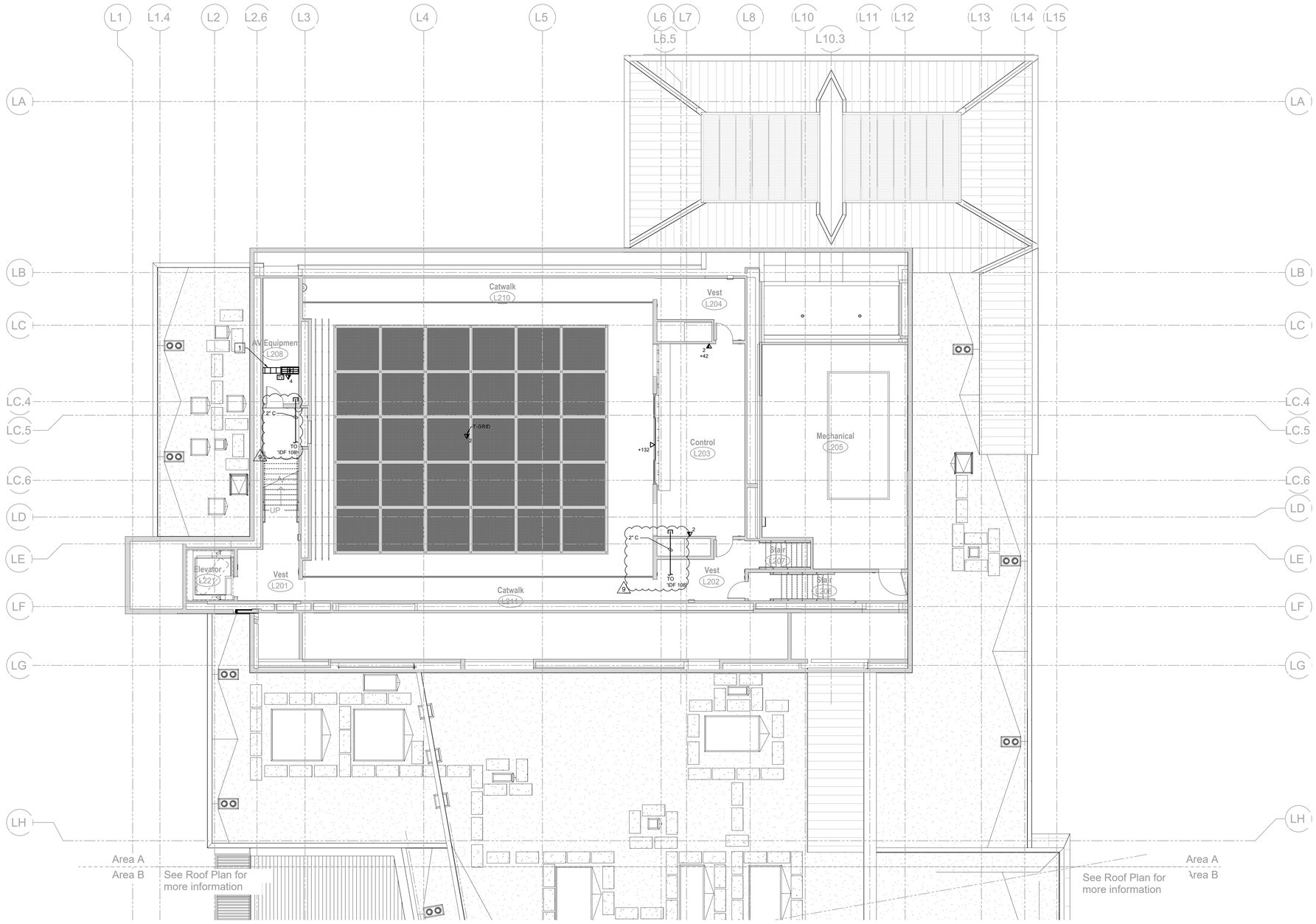
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SCALE: 1/8"=1'-0"

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LICENSED ARCHITECT — RICHARD K. FERRIS — No. C23724 — Exp. 4-30-27 — STATE OF CALIFORNIA

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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, maintain, and implement required 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 trained Contractor staff.
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/wastes, and equipment; cleaning the site of any storm water pollutants, within 90-days of completing outdoor construction activities; and notifying the Owner and QSD when acceptable termination conditions have been achieved.
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
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

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 40 00 – Storm Drainage

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, certificate, 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 for QSP delegation to Contractor staff members within 30 days of starting construction, if

applicable.

D. The Contractor shall provide to the Owner and QSD, completed SWPPP training records of all active Contractor and sub-contractor staff members who's work may contribute stormwater pollutants within 30 days of starting construction.

E. The Contractor shall provide to the Owner and QSD, the current construction schedule within 30 days of starting construction.

F. The Contractor shall provide, to Owner and QSD, a list of sub-contractors within 30 days of starting construction.

G. The Contractor shall submit, to the Owner and QSD, field meter manuals and information for pH and turbidity, if applicable if de-watering is anticipated for the Project, within 30 days of starting construction.

H. The Contractor shall submit, to the Owner and QSD, any proposed product to be used at the site as soil binder or tackifier for the purposes of erosion control for approval.

I. 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.

J. 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 24 hours of completing dewatering field sampling.

K. 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.

L. 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, on-site rain logs, daily NOAA forecast records, QSP-signed inspection reports for delegated reports, completed QSP delegation training records, and completed contractor/sub-contractor SWPPP 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. Completing 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.
   g. 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; and notifying Owner and QSD of acceptable termination conditions.
5. The SWPPP is an aid to the Contractor in complying with the CGP. CGP requirements shall take precedence over anything contained in the SWPPP, Contractor shall notify the Owner and QSD of any conflicts between the SWPPP and CGP, and no such conflicts shall relieve the Contractor of any responsibilities for execution of these specifications.
6. See the approved SWPPP for the determined Project Risk level. The requirements associated with the project's Risk level shall be found in the SWPPP.

B. Retaining a Qualified SWPPP Practitioner (QSP)
1. The Contractor shall retain a certified QSP who will have responsibility and oversight for the implementation of the CSMP elements of the SWPPP and CGP.
2. Contractor shall maintain documentation in the on-site SWPPP and digitally that proves a certified QSP conducted oversight of all SWPPP and CGP compliance activities including, but not limited to:
   a. CSMP inspections, training, weather forecast monitoring and recordkeeping, on-site rain gauge records, de-watering and non-visible pollutant discharge sampling, and recordkeeping. The responsibilities of the Contractor's QSP are explained in Part 3, Section 3.1 of these SWPPP specifications.

C. Non-visible pollutant discharge sampling:
1. The Contractor's QSP shall train Contractor staff members on non-visible pollutant observation and sampling procedures of the CGP and Section 7 of the Project SWPPP. The QSP and QSP trained delegates shall conduct non-visible sampling when required by site observations and activities according to the CGP.
2. The Contractor shall be prepared with a pH field meter, calibration fluid, and clean non-visible pollutant sample bottles and preservatives based on the current non-visible pollutants on-site, as identified in Section 7 of the Project SWPPP.
3. The Contractor shall be prepared to preserve stormwater samples on ice to 4° Celsius immediately after taking stormwater samples and until being driven, picked-up, or

shipped to an ELAP certified laboratory.

4. The Contractor shall pay for all costs related to non-visible pollutant sampling and laboratory analysis.
5. A QSP-trained and delegated Contractor staff member or the QSP shall:
   a. Always be available on-site within one hour during site operation hours to conduct non-visible pollutant discharge sampling as required by the CGP.
   b. Complete the non-visible pollutant sampling procedures identified in Section 7 of the Project SWPPP and according to the CGP immediately after the discovery of exposure of non-visible pollutants to stormwater that have a potential to discharge off-site.
   c. Take non-visible pollutant samples of effluent from waste dumpsters left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
   d. Take non-visible pollutant samples of runoff from demolished building materials left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
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 provide the completed Effluent Field Sampling Log to the QSD and LRP within 24 hours of completing de-watering discharge sampling.
   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.

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 representing the Owner.

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 initiated 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.

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, daily weather monitoring, training of responsible contractor and subcontractor personnel, dewatering sampling and analysis, and incidental non-visible pollutant discharge sampling and laboratory analysis.
      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) All CSMP inspection reports shall be completed in accordance with CGP requirements.
         3) 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 all 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, and post-storm inspections and/or stormwater sampling requirements to Contractor personnel, the QSP shall conduct a foundational training and site-specific training in accordance with CGP requirements.
            a) If CSMP inspection have 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 provide sampling results to the QSD and the Owner within 24 hours of obtaining results.

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 notify via email the RWQCB and the local MS4 (if applicable) 24 hours or more prior to conducting dewatering operations. 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 of turbidity or pH when resuming dewatering operations.
   2) De-watering sample results shall be recorded in the Effluent Field Sampling Log and retained in the on-site SWPPP.
   3) After obtaining de-watering sampling results that exceed acceptable ranges for turbidity and pH, the Contractor QSP shall submit the completed Effluent Filed Sampling Log to the Owner and the QSD within 24 hours.

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.
4. The Contractor shall maintain the SWPPP NOI of Appendix B, SWPPP Site Maps of Appendix A in a hard copy at the Project site.
5. The Contractor shall keep posted the Project WDID# at a publicly viewable location until the SWPPP has been terminated, per CGP requirements.

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.
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

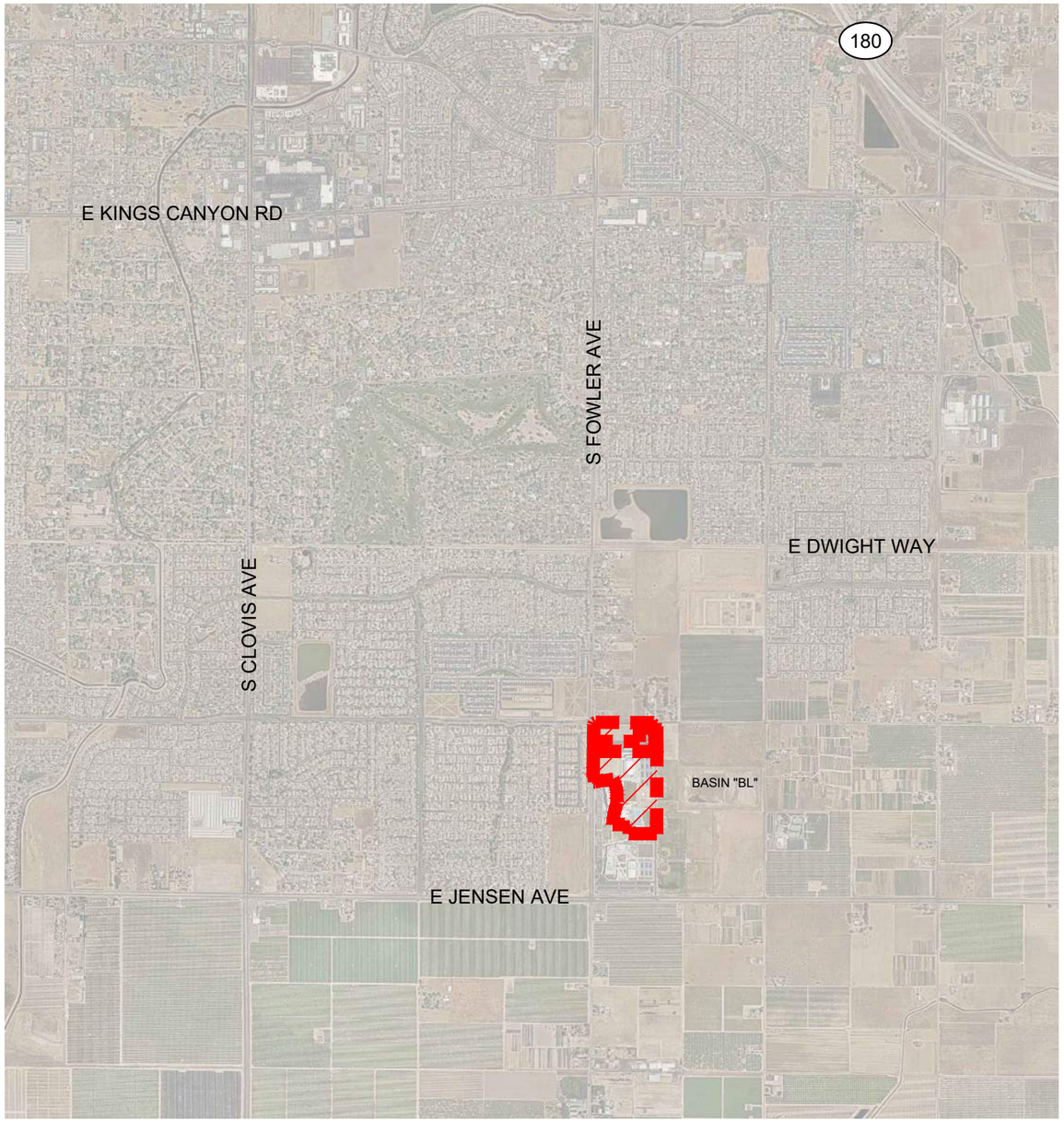
A. Paper and electronic records of all CSMP inspections, testing, training reports, all PRDs, inspection records, site photos, and all other SWPPP related records, shall be retained by the Contractor over until the termination of the SWPPP. Upon the acceptance of the Notice of Termination by the SWRCB, the Contractor shall provide all digital and hard copy records to the Owner.

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.

END OF SECTION



LOCATION MAP
NOT TO SCALE



PROJECT SITE
NOT TO SCALE

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 — FIGURE: 1A

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SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
LOCATION AND VICINITY MAPS

DR. BY AM
CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 1
OF 5 SHEETS

Drawing: P:\222\222-0322\Site\Exhibits\SWPPP 2022\222322_SangerEd_SWPPP_Figures_COI.dwg; Figure 1A Plot by: amagana Oct 06, 2026 - 11:22am

PRE-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 ASPHALT (NON-ROOF IMPERVIOUS AREAS)
- EXISTING CONCRETE (NON-ROOFTOP IMPERVIOUS AREAS)
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
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- 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 WALL (NON-ROOF IMPERVIOUS AREAS)
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY (MULTIPLE COLORS)
- ## DRAINAGE AREA NUMBER
- CA## STORMWATER CONTAINMENT AREA
- CS## STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- SL## 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

NOTES TO CONTRACTOR:

1. 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 DETAILS SHOWN ON FIGURE 1C AND THE CASQA CONSTRUCTION BMP HANDBOOK IN APPENDIX G FOR TECHNICAL DETAILS ON ALL BMPS.
2. IN ADDITION TO THE BMPS DEPICTED HEREON, THE CONTRACTOR AND QSP SHALL BE RESPONSIBLE FOR IMPLEMENTING ADDITIONAL BMPS LISTED IN SECTION 3 OF THE PROJECT SWPPP APPENDIX G, AND THOSE SUMMARIZED IN FIGURE 1C. CONTRACTOR SHALL CONSULT WITH QSP 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 TEXT AND INTENT OF THE CGP.
3. 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.
4. 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.
5. STREET SURFACES SHALL BE SWEPT BY THE CONTRACTOR PER CASQA SE-7. VISIBLE SEDIMENT TRACKING SHALL BE SWEPT OR VACUUMED ON A DAILY BASIS.
6. DUST CONTROL PRACTICES SHALL CONFORM WITH THE LOCAL AIR DISTRICT AND CASQA WE-1.
7. 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.
8. 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.
9. 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.
10. 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.
11. REFER TO THE CONSTRUCTION DRAWINGS FOR MORE DETAIL.

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 — FIGURE: 1B

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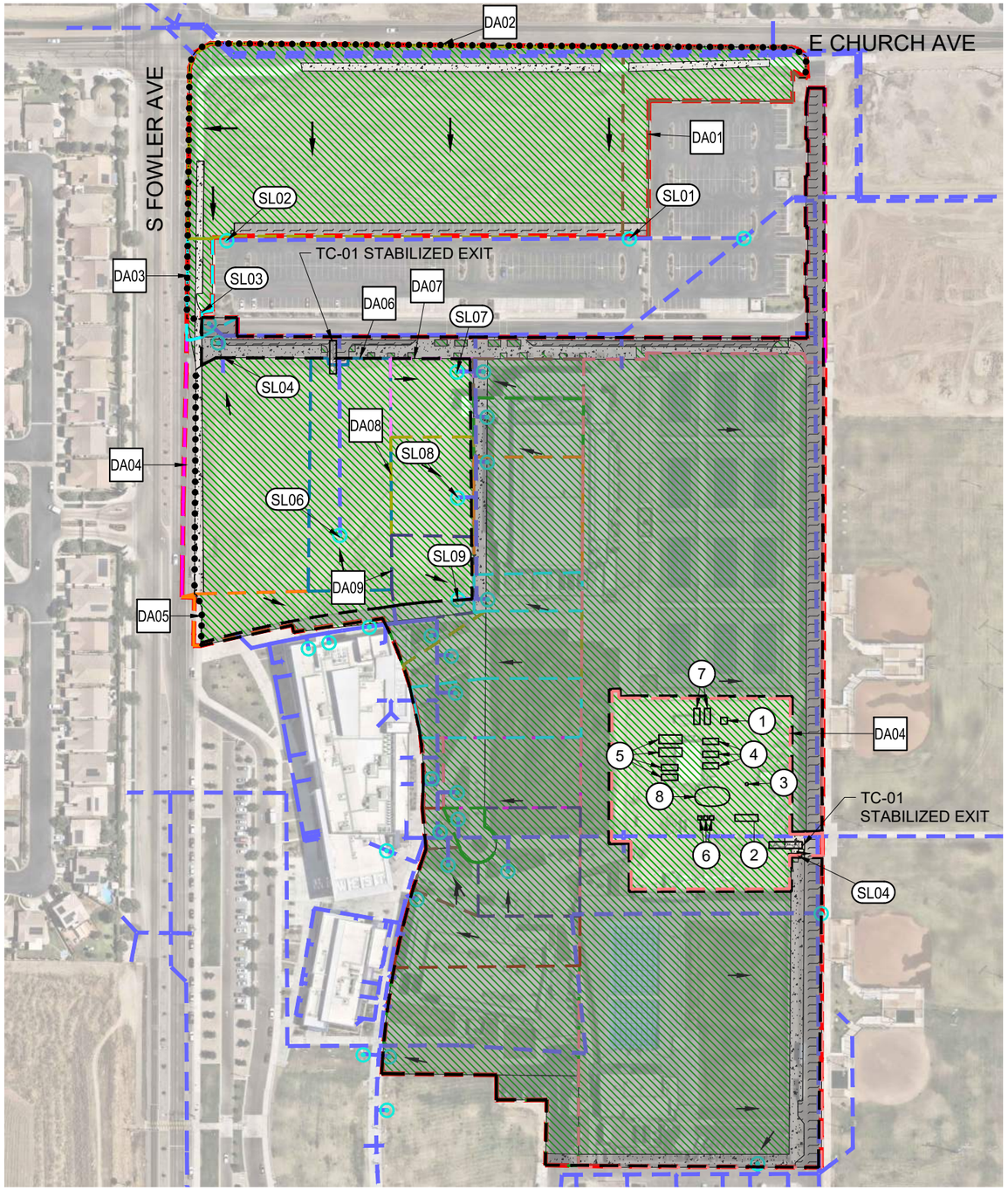
SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
LEGENDS AND NOTES

DR. BY AM
CH. BY GL
DATE 10-05-26
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SHEET NO. 2
OF 5 SHEETS

Drawing: P:\222\222-0322\Site\Exhibits\SWPPP 2022\222322_SangerEd_SWPPP_Figures_COI.dwg; Figure 1B Plot by: amagana Oct 06, 2026 - 11:22am



PRE-EARTHWORK SYMBOL LEGEND:

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- 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.
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- EXISTING CONCRETE (NON-ROOFTOP IMPERVIOUS AREAS)
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

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STAGING AREA ITEMS:

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7. SOLID WASTE STORAGE LOCATION PER CASQA WM-05
8. STOCKPILE STORAGE LOCATION PER CASQW WM-03

N

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SCALE IN FEET

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 — FIGURE: 2

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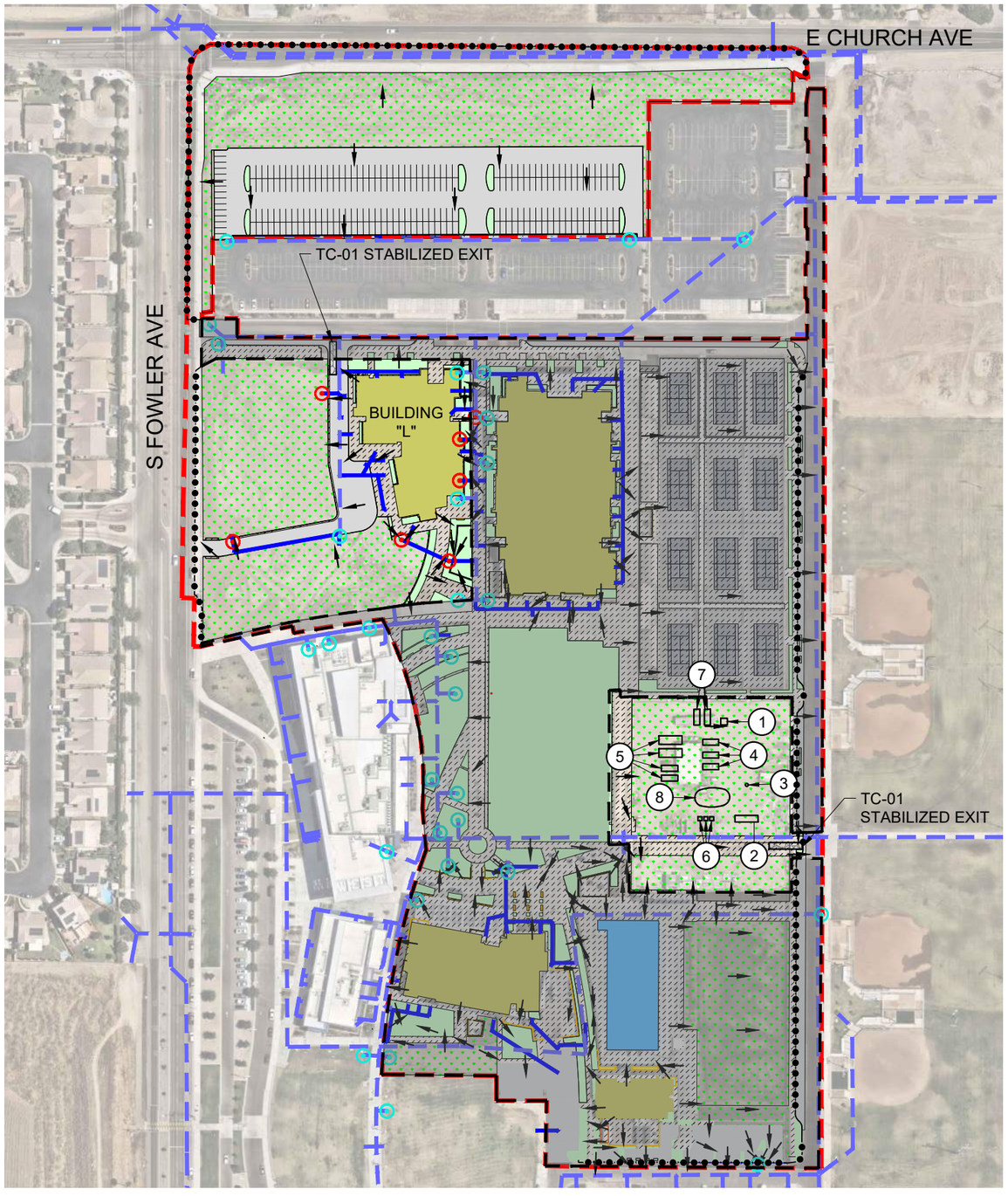
SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
PRE-EARTHWORK SITE MAP

DR. BY AM
CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 3
OF 5 SHEETS

Drawing: P:\222\222-0322\Site\Exhibits\SWPPP 2022\222322_SangerEd_SWPPP_Figures_COI.dwg; Figure 2 Plot by: amagana Oct 06, 2026 - 11:22am



CONSTRUCTION SYMBOL LEGEND:

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SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 | FIGURE: 4

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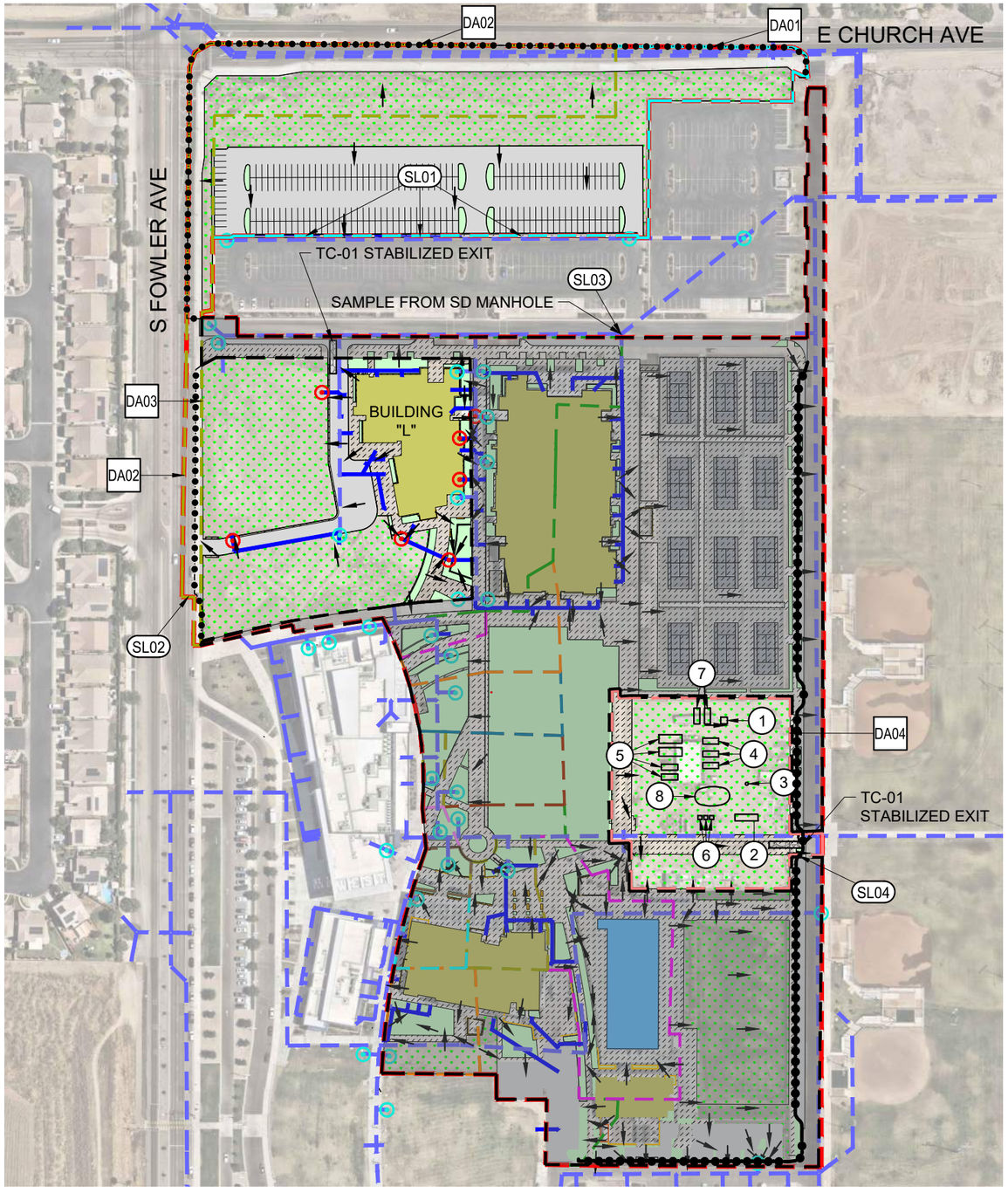
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SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
CONSTRUCTION SITE MAP

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DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 4
OF 5 SHEETS



CONSTRUCTION SYMBOL LEGEND:

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3. LOCATION OF RAIN GAUGE
4. MATERIAL STORAGE LOCATION PER CASQA WM-01
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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

N

0 50 100 200 300 400
SCALE IN FEET

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 FIGURE: 4.i

Blair, Church & Flynn CONSULTING ENGINEERS

CONSULTANT
Blair, Church & Flynn Consulting Engineers
401 Clovis Avenue, Suite 205
Clovis, California 93612
Tel (559) 325-1400
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SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
DRAINAGE AREA AND SAMPLING SITE MAP - CONSTRUCTION

DR. BY AM
CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 5
OF 5 SHEETS

STORMWATER POLLUTION PREVENTION PLAN

for

Sanger Education Center – Phase 3

Project Location:
Fresno, CA

RISK LEVEL: 1

Legally Responsible Person (LRP):
Sanger Unified School District
1905 Seventh Street, Sanger, CA 93657
Jimmy Robles
(559) 524-7600
Project Address:
1760 S. Fowler Ave. Fresno, CA 93727

SWPPP Prepared by:

Blair, Church & Flynn
CONSULTING ENGINEERS
Michael Gennaro
451 Clovis Avenue #200, Clovis, CA 93612



SWPPP Preparation Date:
August 1, 2025

WDID #	5F10C408288
Application ID	584353

Estimate Construction Dates
November 1, 2021 – May 31, 2029

Site Operation Hours
7 am – 5 pm, M-F

Contact	Name	Phone Number	License/Certification #
Qualified SWPPP Developer	Michael Gennaro	(559) 326-1400	#28547
Co-Qualified SWPPP Developer	Gabriel Ledesma	(559) 326-1400	#28909
Co-Qualified SWPPP Developer	Alycia Magana	(559) 326-1400	#85204
Qualified SWPPP Practitioner	Alan Mok	(559) 432-6879	#00362
QSP Trained Delegates	Cesar Rocha	(559) 620-9059	N/A
QSP Trained Delegates			

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List of Acronyms

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)

Approval and Certification of the Stormwater Pollution Prevention Plan

Project Name: Sanger Education Center – Phase 3

Project Number/ID: **5F10C408288**

"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

August 1, 2025

Date

Michael Gennaro

QSD Name

28547

QSD Certificate Number

QSD, CPESC, Environmental Specialist at Blair, Church & Flynn Consulting Engineers

Title and Affiliation

(559) 326-1400

Telephone Number

mgennaro@bcf-engr.com

Email

Qualified SWPPP Practitioner (QSP)

Project Name: Sanger Education Center – Phase 3

Project Number/ID: **5F10C408288**

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.

QSP Signature	*Date*
QSP Name	*QSP Certificate Number*
Title and Affiliation	*Telephone Number*
Email	

Amendment Log

Project Name: Sanger Education Center – Phase 3

Project Number/ID: **5F10C408288**

Amendment No.	Date	Brief Description of Amendment (include section and page number)	Prepared and Approved By
0	07/30/25	Note that this SWPPP was prepared to replace the Sanger Ed Center Ph 2A & 3 SWPPP (WDID# 5F10C396114). This new SWPPP was prepared to authorize the SWPPP under the 2022 CGP.	Name: Michael Gennaro QSD# 28547
1	06/03/26	**Purpose:** Extend Construction End date to May 31, 2029 1. Changed estimated end date to May 31, 2026 on Cover Page. 2. Updated Table 2-3 Summary of Sediment Risk to reflect new timeline (pg. 2-3). 3. Updated Estimate Project End Date to May 31, 2029 in Section 2.5 – Construction Schedule (pg. 2-5). Updated the Risk Determination in Appendix B to include new Erosivity Factor from new construction end date.	Name: Gabriel Ledesma QSD# 28909
2	10/05/26	**Purpose:** Remove completed areas of construction, add new phase of construction 1. Changed the name of project to match construction phase on Cover Page 2. Added Co-Qualified QSD on Cover Page 3. Updated Project acreage and disturbance (pg. 1-1, 2-1). 4. Updated Section 2.1.4 Geology and Groundwater (pg. 2-2). 5. Updated Project grading acreage in Section 2.1.5 and Table 2-2 (pg. 2-2). 6. Updated Table 7-2 to remove sample locations (pg. 7-7).	Name: Alycia Magana QSD# 85204

Amendment No.	Date	Brief Description of Amendment (include section and page number)	Prepared and Approved By
		7. Updated Table 7-3 to remove dewatering locations no longer within project boundaries (pg. 7-8). 8. Updated Table 7-4 to remove drainage areas no longer within project boundaries (pg. 7-12). 9. Updated site maps in Appendix A to removed completed construction phases. 10. Added QSD Amendment Certification #2 in Appendix C. 11. Added new QSD certificate in Appendix J.	

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

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 Sanger Education Center – Phase 3 project (Project, or Site) comprises approximately 10.87 acres, of which 9.51 acres will be disturbed. The Project is located at 1760 S. Fowler Ave. Fresno, CA 93727. The property is owned and being developed by Sanger Unified School District . The project's location is shown on the Site Maps in Appendix A.

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 (1)	Indicates changes that may be field located or field determined by QSP/Delegates	
Increase quantity of Erosion or Sediment Control Measures	☒ Yes	☐ No
Relocate/Add stockpiles or stored materials	☒ Yes	☐ No
Relocate/Add toilets – Shall include a containment tray	☒ Yes	☐ No
Relocate vehicle storage and/or fueling locations	☒ Yes	☐ No
Relocate concrete waste management facilities	☒ Yes	☐ No
Relocate areas for waste storage	☒ Yes	☐ No
Relocate water storage and/or water transfer location	☒ Yes	☐ No
Changes to access points (entrance/exits)	☒ Yes	☐ No
Change type of Erosion or Sediment Control Measures – Changes may only include BMPs indicated within Section 3.1 of this SWPPP	☒ Yes	☐ No
Changes to location of Erosion or Sediment Control Measures	☒ Yes	☐ No
Minor changes to schedule or phases	☒ Yes	☐ No
Changes in construction materials	☒ Yes	☐ No
(1) Any field changes not identified for field location or field determination by the QSP must be made as an amendment by the QSD.		

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.

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

2.1 PROJECT AND SITE DESCRIPTION

2.1.1 Site Description

The Sanger Education Center – Phase 3 project site is Risk Level 1, comprises approximately 10.87 acres, and is located at 1760 S. Fowler Ave. Fresno, CA 93727. The project site is located approximately 2.25 miles southwest of Highway 180. The project site is not near any receiving waters and is located approximately 0.3 miles west of Fresno Metropolitan Flood Control District (FMFCD) stormwater basin BL. The project is located at (36.71199/-119.68041) 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 undeveloped former agricultural land. The project site was disturbed recently by staging activities for construction of the Sanger Ed Center Phase 1A, Phase 1B, and Phase 2 Projects.

There are no known historical sources of potential contamination at the project site according to the Department of Toxic Substances Control (DTSC) *Envirostor* database (California Department of Toxic Substances Control, 2025).

There are no Leaky Underground Storage Tanks (LUST), near the Project site, according to the SWRCB's GeoTracker database (State Water Resources Control Board (1), 2025).

2.1.3 Existing Drainage

The project site is relatively level (slightly slopes southwest). The elevation of the project site ranges from 316 feet- 320 feet above mean sea level (msl). Surface drainage at the site currently percolates into the mostly pervious undeveloped land or, under heavy rains, will discharge out of the site to surrounding streets where stormwater will convey over curb gutters to FMFCD drain inlets. All FMFCD drain inlets around the Project site convey stormwater east to FMFCD Stormwater basin BL. 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 basin BL. 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[1]	TMDL (2022 CGP Table H-1)
FMFCD Stormwater Basin "BL"	None	None

[1] (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

The site is underlain by 77.3% Exeter sandy loam and 22.7% Delhi loamy sand. Exeter sandy loam is characterized by sandy loam from 0 to 30 in below surface level (bsl) and cemented material from 30 to 40 in bsl. Delhi loamy sand is characterized by loamy sand from 0 to 60 in bsl, according to the USDA Web Soils Survey (U.S. Division of Agriculture, 2025).

According to a groundwater monitoring well approximately 1.7 northeast of the project site (Site Code: 367275N1196558W001) with most recent measurements from October 16, 2024, groundwater occurs beneath the site at approximately 91.9 feet below ground surface. The groundwater gradient is toward the east (California Department of Water Resources, 2025).

2.1.5 Project Description

Project grading will occur on approximately 8.41 acres of the project, which comprises approximately 62.6 percent of the total area. The limits of grading are shown on Site Maps Figure 3 & 4 in Appendix A. Grading will include both cut and fill activities, with the total graded material estimated to be balanced with no expected soil importing or hauling Soil will be stockpiled in the staging area located in the southwest area of the site as shown on Site Maps Figure 3 & 4 in Appendix A. Construction activities will not be phased, but the project is part of a long-term master plan that expects future site improvements.

Table 2-2 Construction Site Estimates

	Acres	Percent of Site
Total Construction site area	10.87	100
Area of disturbance	9.51	87.5
Area of grading	8.41	88.4

2.1.6 Developed Condition

Post construction surface drainage will flow to onsite storm drains which will convey to FMFCD systems ending in FMFCD basin BL. A minority of stormwater will sheet flow northwest at the site perimeter during rain events and drain to FMFCD gutter drains, also conveying to basin BL.

Post-construction drainage patterns and conveyance systems are presented on Site Maps Figure 4 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 FMFCD 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

There is no anticipated offsite run-on to this construction site because the project is all above grade of surrounding streets and properties.

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 S*ites 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,
- 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

RUSLE Factor	Value	Method for Establishing Value
R	194.83	EPA's *Rainfall Erosivity Factor Calculator for Small Construction S*ites
K	0.32	SWRCB K-Factor Map, Generated by SMARTS
LS	0.1436	SWRCB LS-Factor Map, Generated by SMARTS

Table 2-3 Summary of Sediment Risk

RUSLE Factor	Value	Method for Establishing Value
Total Predicted Sediment Loss (tons/acre)		**8.95**
Overall Sediment Risk Low Sediment Risk < 15 tons/ acre Medium Sediment Risk >= 15 and < 75 tons/acre High Sediment Risk >= 75 tons/acre		☒ **Low** ☐ **Medium** ☐ **High**

The project site discharges into FMFCD stormwater basin BL.

Table 2-4 Summary of Receiving Water Risk

Receiving Water Name	303(d) Listed for Sediment Related Pollutant (1)	TMDL for Sediment Related Pollutant (1)	Beneficial Uses of COLD, SPAWN, and MIGRATORY (1)
FMFCD Basin BL	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Overall Receiving Water Risk			☒ **Low** ☐ **High**
(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

TMDL	Parameter	Unit	Numeric Action Level	Numeric Effluent Limit
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: November 1, 2021

Estimate Project End Date: May 31, 2029

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.

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

TMDL	Applicable Water Body/ Watershed	Pollutants	Additional TMDL-Related NAL or NEL	Compliance Actions
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. (1)	Required Element
Pre-Earthwork Drawings	
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
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 2	Proposed locations of demolition
Figure 2	Proposed locations of other construction support activities
Construction and Earthwork Drawing(s)	
Figures 3 and 4	Site layout (grading plans) including roads
Figures 3 and 4	Site and project boundaries
Figures 3 and 4	Drainage areas
Figures 3 and 4	Discharge locations
Figures 3 and 4	Sampling locations
Figures 3 and 4	Areas of soil disturbance (temporary or permanent)

Table 2-9 Required Map Information

Included on Map/Plan Sheet No. (1)	Required Element
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

	BMP	Location	Implementation	Duration
Erosion Control BMPs	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

	BMP	Location	Implementation	Duration
	~~EC-11, Slope Drains~~	~~Designed slope drains.~~	~~After completing construction of a new drain and outfall.~~	~~1-3 weeks.~~
	~~EC-12, Streambank Stabilization~~	~~Stream banks, with applicable permits from USACE, SWRCB, and CDFW.~~	~~Prior to disturbing large upland areas that will increase stormwater discharge volume to stream.~~	~~1-2 weeks. Ongoing maintenance.~~
	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.
Sediment Control BMPs	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.
	~~SE-2, Sediment Basin~~	~~At designed sediment basin location for Project.~~	~~Prior to mass grading.~~	~~1-3 months. Ongoing maintenance.~~
	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

	BMP	Location	Implementation	Duration
	~~SE-9, Straw Bale Barrier~~	~~Flat areas below disturbed slopes. Site perimeter.~~	~~Prior to disturbing slopes. Prior to commencing grading (perimeter control).~~	~~1-2 weeks. Ongoing maintenance.~~
	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.
	~~SE-11, Active Treatment Systems~~	~~Per ATS plan.~~	~~Per ATS plan.~~	~~Per ATS plan.~~
	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.
	~~SE-14, Biofilter Bags~~	~~Areas needing immediate sediment control BMPs, including: perimeter controls, DI protections, and as a check dam.~~	~~During Construction~~	~~1 day. Ongoing maintenance and replacement.~~
Wind Erosion Control BMPs	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

	BMP	Location	Implementation	Duration
	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.
Tracking Control BMPs	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.
	~~TC-3, Entrance/Outlet Tire Wash~~	~~Inside site adjacent to exits/entrances.~~	~~Start of Construction, prior to grading. As needed to supplement TC-1.~~	~~2-3 weeks. Ongoing maintenance.~~
Non-Stormwater Control BMPs	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.
	~~NS-4, Temporary Stream Crossing~~	~~Designated crossing locations, with applicable permits from USACE, SWRCB, and CDFW.~~	~~Prior to stream crossing~~	~~1-3 weeks.~~
	~~NS-5, Clear Water Diversion~~	~~Work areas in water bodies.~~	~~Prior to construction in water bodies~~	~~1-4 weeks. Ongoing maintenance.~~
	NS-6, Illicit Connection-Illegal Discharge Connection	Entire site.	During Construction	Ongoing.

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
	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.
	~~NS-11, Pile Driving Operations~~	~~Pile driving and equipment storage locations~~	~~Prior to pile driving equipment arriving on-site~~	~~1 day to install. Ongoing.~~
	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.
	~~NS-14, Material Over Water~~	~~Planned work areas over water, with applicable permits from USACE, SWRCB, and CDFW.~~	~~Prior to work over water and during.~~	~~Ongoing.~~
	~~NS-15, Demolition Adjacent to Water~~	~~Planned demolition areas adjacent to water~~	~~Prior to start of demolition and during.~~	~~1-5 days to install. Ongoing~~
	~~NS-16, Temporary Batch Plants~~	~~Designated temporary batch plant location.~~	~~At start of construction of temporary batch plant and ongoing during operation and storage.~~	~~Planning prior to batch plant construction and ongoing until all materials are removed from site.~~
Constructi on Material	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

	BMP	Location	Implementation	Duration
	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
Waste Management Control BMPs	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
	~~WM-7, Contaminated Soil Management~~	~~Identified contaminated soil locations.~~	~~Prior to disturbance of contaminated soil areas and ongoing until disposal of hazard soil and final stabilization of hazard soil location.~~	~~Ongoing until all hazard soil is removed from site or stabilized.~~
	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 [1]	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	✓[2]	✓		
EC-4	Hydroseed	✓[2]	✓		
EC-5	Soil Binders	✓[2]	✓		
EC-6	Straw Mulch	✓[2]	✓		
EC-7	Geotextiles and Mats	✓[2]	✓		
EC-8	Wood Mulching	✓[2]	✓		
EC-9	Earth Dike and Drainage Swales	✓[3]	✓		
EC-10	Velocity Dissipation Devices	✓[3]	✓		
EC-11	Slope Drains	✓[3]		✓	There are no outfalls to slopes that require BMP.
EC-12	Stream Bank Stabilization	✓		✓	Project does not drain to stream.
EC-14	Compost Blankets	✓[2]		✓	Not necessary for Project with mild slopes.
EC-15	Soil Preparation-Roughening	✓	✓		
EC-16	Non-Vegetated Stabilization	✓[2]	✓		
WE-1	Wind Erosion Control	✓	✓		

[1] 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.
[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements.
[3] 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.

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 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 Preperation 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–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.
- 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 rip-rap 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:

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 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.

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 [1]	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
SE-1	Silt Fence	✓[2] [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	✓[2][3]	✓		
SE-6	Gravel Bag Berm	✓[3]	✓		
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	✓[3]	✓		
SE-14	Biofilter Bags	✓[3]		✓	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.

[1] 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.
[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements.
[3] 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-I 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 ¼ to 1/3 of the thickness of the roll, with a width the same diameter as the 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 ¼ to 1/3 of the thickness of the roll, with a width the same diameter as the 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. MCLSs 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 MLCSs 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 Contactor 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 shall utilize the existing or new 100+ ft of pavement within the Project site as a stabilized construction exit for removing sediment from construction vehicles from the site, as shown in Appendix A: Site Maps, Figures 2 through 4. The Contractor shall monitor this exit 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 [1]	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.

[1] 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. 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 manor that prevents the violation of water quality standards. One or more of the following equipment shall 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.
- **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
- **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 proceedures 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 of 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 [1]	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	✓	✓		

[1] 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 pain 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 minder (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
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals
- Fuels
- Lubricants
- Other petroleum distillates

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

Material	**Released to**	**Quantity**
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 waster 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 wase 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, 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 FMFCD MS4 program, this project is exempt from 2022 CGP Provision IV.N.3. The MS4's post construction requirements and the post-construction plans and calculations approved by the MS4 were uploaded as part of the PRDs as required by 2022 CGP Provision IV.N.2. The approved Long-Term Maintenance Plan will be uploaded with the NOT.

Section 4 BMP Inspection and Maintenance

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 withing 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

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
Jimmy Robles	Signatory of the LRP, Chief Operations Officer	(559) 524-7600

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
QSP	X	X	X	X	X	X	X
QSP Delegate	X		X	X			

6.2 CONTRACTOR LIST

Contractor Name:	Steven Valdez
Title:	Project Manager
Contractor Company:	Harris Construction Co., Inc.
Address	5286 E. Home Avenue, Fresno, CA 93727
Phone Number:	(559) 251-0301
Phone Number (24/7)	(559) 217-4630

Section 7 Construction Site Monitoring Program

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: 7 am – 5 pm, 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
Routine Inspections[1]	
Site Entrances/Exits	Daily
Hazardous Material/Waste storage areas	Daily
BMP Inspections	Weekly[2]
Qualifying Precipitation Event Triggered Inspections	
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 [2]
BMP Inspections During an Extended Qualifying Precipitation Event	Once every 24-hour period of a qualifying precipitation event[3]
Site Inspections Following a Qualifying Precipitation Event	Within 96 hours of a qualifying precipitation event[2]

[1] Inspections are required during scheduled site operating hours.

[2] Most BMPs must be inspected weekly; those identified below must be inspected more frequently.

[3] 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:	Alan Mok	Phone #:	(559) 432-6879
Assigned QSP Delegate:	Cesar Rocha	Phone #:	(559) 620-9059
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 and Sampling 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, drainage areas and associated discharge/sampling locations of the Project site will change throughout construction. The SWPPP identifies three main conditions for pre-earthwork, earthwork, and construction/post-stormwater conveyance system construction for the purposes of identifying the main drainage areas and associated discharge/sampling

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/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.

The number of drainage areas and associated discharge/sampling locations that have a potential to discharge non-visible pollutants from anticipated construction activities and known soil conditions are summarized below:

Pre-earthwork Site Condition:

There is a total of 24 drainage areas. Zero drainage areas are planned for landscaping activities that could contribute non-visible pollutants from soil amendments and herbicide application. Zero drainage areas area identified with contaminated soil by historic usage of the site. Zero drainage areas and associated discharge/sampling locations could be impacted from run-on that could combine with discharges from the site being sampled for non-visible pollutants. Run-on sampling locations for these drainage areas are identified to determine if run-on to sampling locations are a source of non-project related non-visible pollutants.

Zero 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 within the same sampled drainage area 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.

Earthwork/Construction/Post-stormwater System Construction Site Condition:

There is a total of 17 drainage areas. A total of 17 of drainage areas are planned for landscaping activities that could contribute non-visible pollutants from soil amendments and herbicide application. Zero drainage areas area identified with contaminated soil by historic usage of the site. Zero drainage areas and associated discharge/sampling locations could be impacted from run-on that could combine with discharges from the site being sampled for non-visible pollutants. Run-on sampling locations for these drainage areas are identified to determine if run-on to sampling locations are a source of non-project related non-visible pollutants.

Zero 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 within the same sampled drainage area 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.

Details of the three main drainage conditions summarizing, drainage areas and associated discharge locations, and sampling locations are presented in Table 7-2 below.

Table 7-2 Drainage Areas, Discharge Locations, and Non-Visible Pollutant Sample Locations

Pre-Earthwork Site Condition				
Sample Location Identifier	**Drainage Area Location/Description**	**Discharge/Sample Location Description**	**Sample Lat/Long** (Decimal Degrees)	**Runoff or Run-on**
SL 1	DA01: Northeast edge of site along E Church Ave	Existing drain inlet in north parking lot	36.714087, -119.679802	Runoff
SL 2	DA02: Northwest edge of site along E Church Ave	Existing drain inlet in north parking lot	36.714061, -119.681713	Runoff
SL 3	DA03: Curb along S Fowler Ave	Southwest corner of north parking lot	36.713618, -119.681834	Runoff
SL 4	DA04: West edge of site along S Fowler Ave	West edge of existing concrete walkway	36.713594, -119.681790	Runoff
SL 5	DA05: Southwest edge of project site, area north of existing campus buildings	Existing drain inlet	36.712477, -119.681259	Runoff
SL 6	DA06: Area around the north construction entrance/exit	Existing drain inlet	36.712735, -119.681173	Runoff
SL 7	DA07: Area west of existing concrete walkway 1	Existing drain inlet	36.713395 -119.680543	Runoff
SL 8	DA08: Area west of existing concrete walkway 2	Existing drain inlet	36.713053, -119.680540	Runoff
SL 9	DA09: Area west of existing concrete walkway 3	Existing drain inlet	36.712604, -119.680513	Runoff
SL 24	DA 24: East project site and existing campus walkway`	Existing drain inlet	36.710184, -119.679002	Runoff
Construction Site Condition				
Sample Location Identifier	**Drainage Area Location/Description**	**Discharge/Sample Location Description**	**Sample Location Latitude and Longitude** (Decimal Degrees)	**Runoff or Run-on**
SL 1	DA 01: North Disturbed Area	south perimeter	36.714030, -119.680758	Runoff
SL 2	DA 02: Southwest edge of site along S Fowler Ave	Pavement along S Fowler Ave	36.713166,-119.681960	Runoff
SL 3	DA 03: North Building Site	SD manhole	36.713630, -119.679716	Runoff
SL 4	DA 04: East project site, existing campus walkway, landscaping, and south parking lot	Existing drain inlet	36.710184, -119.679002	Runoff

Stormwater storage or containment area(s) that may be dewatered or discharge after heavy rainfall are shown on the Site Maps in Appendix A and listed in Table 7-3 below for each site condition.

Table 7-3 Stormwater Storage and Containment Areas (Dewatering Locations)

Location	
Location No.	**Pre-Earthwork Site Condition**
N/A	N/A
Earthwork/Construction/Post-Stormwater System Site Condition	
N/A	N/A

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 7-4 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 each site condition and associated discharge/sampling locations are identified in Table 7-2 and shown in the Site Maps in Appendix A.

Table 7-4 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	Grading and Construction Site Drainage Area
PCBs (from demolished structures from 1950-1980)	PCBs	Building Demolition	No	None	None
Lead Paint	Pb	Building Demolition	No	None	None
Gypsum / Lime amendments	pH	Grading / Earthwork	No	None	All
Contaminated soil	Constituents specific to known contaminants, check with Laboratory	Grading / Earthwork	No	None	All
Sealant (Methyl methacrylate)	SVOC	Concrete Masonry Work	No	None	3, 4
Curing compounds	VOCs, SVOCs, pH	Concrete Masonry Work	No	None	3, 4
Ash, slag, sand	pH, Al, Ca, Va, Zn	Concrete Masonry Work	No	None	3, 4
Treated Wood	Cu, CR, As, Zn	Carpentry Work	No	None	3, 4
Particle Board	Formaldehyde	Carpentry Work	No	None	3, 4
Untreated Wood	BOD	Carpentry Work	No	None	3, 4
Drywall	Cu, Al, CA, VA, Zn	Building Construction	No	None	3, 4
Solder, flux, pipe fitting	Cu, Pb, Sn, Sn	Plumbing	No	None	3, 4
Roofing Compound	Cu, Pb, VOC	Roofing	No	None	3, 4
Insulation	Al, Zn	Insulation	No	None	3, 4
Resins, Thinners, Paint Strippers, Lacquers, varnishes, enamels, Sealants, Adhesives	COD, SVOCs, VOCs, Metals, Phenols	Painting	No	None	3, 4
Chlorinated water	Residual Chlorine, Chloramines	Utility Line Testing and Flushing	No	None	3, 4
Pesticides/ Herbicides	Product dependent, see label and check with Laboratory	Vegetation Management	No	None	All
Vegetation Stockpiles	BOD	Vegetation Management	No	10	10

Table 7-4 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	Grading and Construction Site Drainage Area
Fertilizers	TKN, NO_3, BOD, COD, DOC, Sulfate, NH_3, Phosphate Potassium	Landscaping	No	None	All
Aluminum Sulfate	AL, TDS, Sulfate	Landscaping/soil amendments	No	None	All
Liquid Waste	Constituents specific to materials, check with Laboratory	Liquid Waste	No	All	All
Sewer line breaks and Portable Toilets	BOD, Total/Fecal coliform	Sanitary Waste	No	10	3
Polymer/Co-polymers	TKN, NO_3, BOD, COD, DOC, Sulfate, Ni	Soil Preparation / Amendments / Dust Control	No	None	All
Lignin sulfate	TDS, Alkalinity	Soil Amendments/ Dust Control	No	None	All
Psyllium	COD, TOC	Soil Amendments/ Dust Control	No	None	All
Guar/Plant Gums	COD, TOC, Ni	Soil Amendments/ Dust Control	No	None	All
Batteries	Sulfuric Acid, Pb, pH	Vehicle and Equipment Use	No	All	All
Freon	Freon	Heating, Ventilation, Air Conditions	No	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 in the locations identified in Table 7-2 above.

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 7-5 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 7-2 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 7-5. 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 7-5 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, H_2SO_4 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
NO_3	EPA 353.2	1 x 250 mL	Glass-Amber	Store at 4°C, H_2SO_4	0.05 mg/L	28 days
NH_3	EPA 350.1	1 x 250 mL	Glass-Amber	Store at 4°C, H_2SO_4	0.01 mg/L	
TKN	EPA 351.1	1 x 250 mL	Glass-Amber	Store at 4°C, H_2SO_4 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, HNO_3 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, H_2SO_4 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 7-5.

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:	Lisa Cardenas
ELAP Certification Number:	01180CA

Samples will be delivered to the laboratory by:

Driven by QSP/QSP Delegate/Contractor	☒	Yes	☐	No
Picked up by Laboratory Courier	☐	Yes	☒	No
Shipped	☐	Yes	☒	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 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 7-6 below. A NAL exceedance occurs when a single sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-6. Dewatering sampling is to be performed within the first hour of commencement of discharge and daily each day that the discharge continues.

Table 7-6: 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 if 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 7.6.

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 7.6.

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 7-7 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 contacting 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 of 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 7-7 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 7-7 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 7-7, 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	☒	Yes	☐	No
QSD Delegate	TBD	☒	Yes	☐	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 7-7 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[1] protocols and analysis, and equipment calibration shall be in accordance with field instrument manufacturer's specifications. Table 7-8 below lists the type of instruments used in the field for these parameters.

Table 7-8: Field Analysis Instrumentation

Field Instrument	EPA Analytical Method	Parameter	MDL
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 7-9 below.

[1] 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 7-9: 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 7-9.

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 7-9.

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 7-10 Dewatering Notification Contacts

Agency	Name	Email
Regional Water Board	Fresno Branch Office	R5f_stormwater@waterboards.ca.gov
FMFCD	Environmental Resources Dept.	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:

Name	Training
Alan Mok	P.E., QSD/QSP Training
Cesar Rocha	QSP-Delegate Training

The QSP and QSP Delegates have the following stormwater sampling experience:

Name	Experience
Alan Mok	QSD/QSP Experience
Cesar Rocha	QSP-Delegate Experience

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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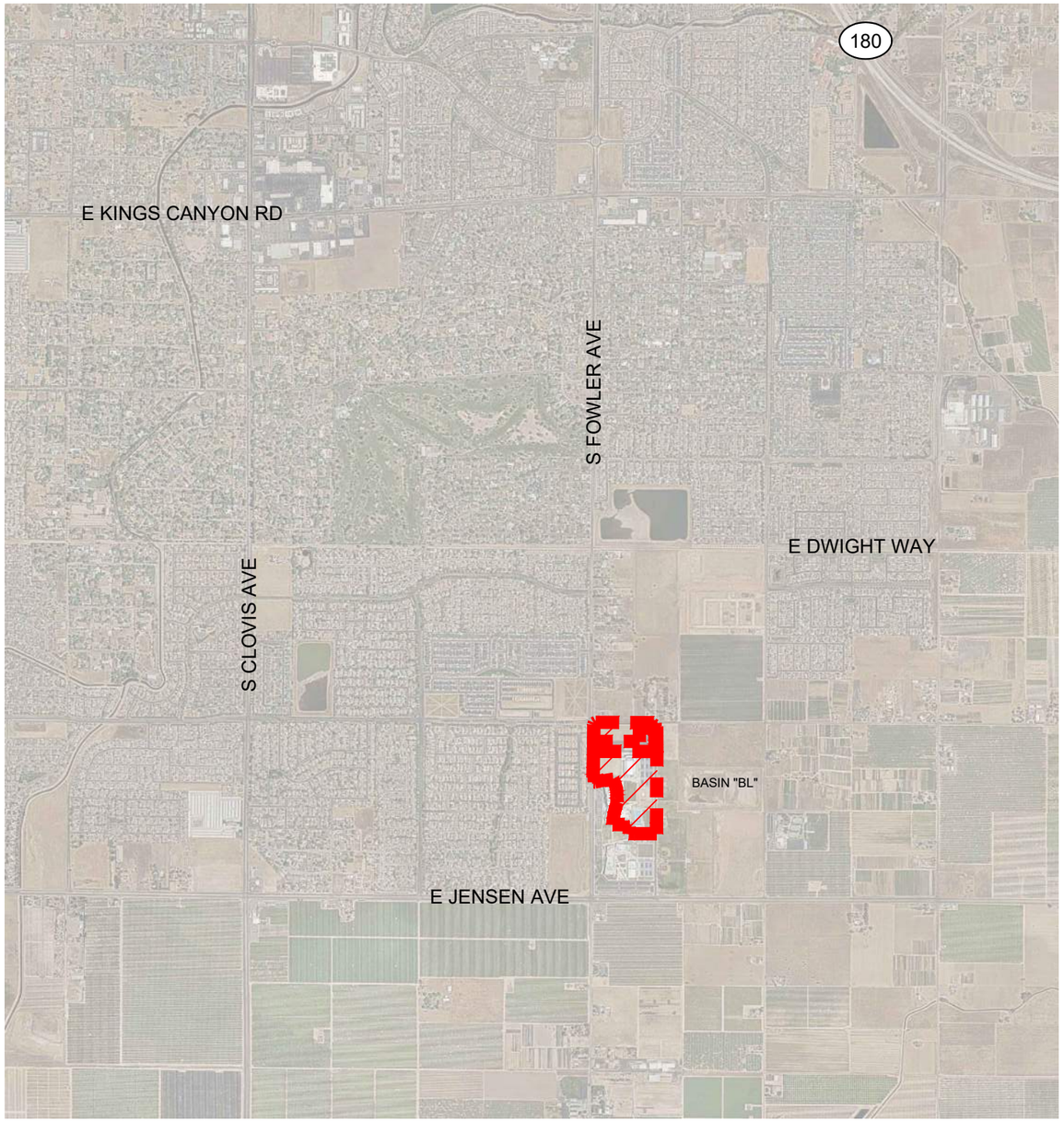
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Appendix A: Site Maps and Drawings



LOCATION MAP
NOT TO SCALE



PROJECT SITE
NOT TO SCALE

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 — FIGURE: 1A

Blair, Church & Flynn CONSULTING ENGINEERS

CONSULTANT
Blair, Church & Flynn Consulting Engineers
400 Clovis Avenue, Suite 200
Clovis, California 93612
Tel (559) 326-1400
Fax (559) 326-1500

SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
LOCATION AND VICINITY MAPS

DR. BY AM
CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 1
OF 5 SHEETS

Drawing: P:\222\222-0322\Site\Exhibits\SWPPP 2022\222322_SangerEd_SWPPP_Figures_COI.dwg; Figure 1A Plot by: amagana Oct 06, 2026 - 11:22am

PRE-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 ASPHALT (NON-ROOF IMPERVIOUS AREAS)
- EXISTING CONCRETE (NON-ROOFTOP IMPERVIOUS AREAS)
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

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
- PROPOSED STORM DRAIN PIPELINE
- PROPOSED ASPHALT CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED POOL
- 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 WALL (NON-ROOF IMPERVIOUS AREAS)
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY (MULTIPLE COLORS)
- ## DRAINAGE AREA NUMBER
- CA## STORMWATER CONTAINMENT AREA
- CS## STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- SL## 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

NOTES TO CONTRACTOR:

1. 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 DETAILS SHOWN ON FIGURE 1C AND THE CASQA CONSTRUCTION BMP HANDBOOK IN APPENDIX G FOR TECHNICAL DETAILS ON ALL BMPS.
2. IN ADDITION TO THE BMPS DEPICTED HEREON, THE CONTRACTOR AND QSP SHALL BE RESPONSIBLE FOR IMPLEMENTING ADDITIONAL BMPS LISTED IN SECTION 3 OF THE PROJECT SWPPP APPENDIX G, AND THOSE SUMMARIZED IN FIGURE 1C. CONTRACTOR SHALL CONSULT WITH QSP 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 TEXT AND INTENT OF THE CGP.
3. 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.
4. 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.
5. STREET SURFACES SHALL BE SWEPT BY THE CONTRACTOR PER CASQA SE-7. VISIBLE SEDIMENT TRACKING SHALL BE SWEPT OR VACUUMED ON A DAILY BASIS.
6. DUST CONTROL PRACTICES SHALL CONFORM WITH THE LOCAL AIR DISTRICT AND CASQA WE-1.
7. 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.
8. 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.
9. 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.
10. 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.
11. REFER TO THE CONSTRUCTION DRAWINGS FOR MORE DETAIL.

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 — FIGURE: 1B

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Fax (559) 326-1500

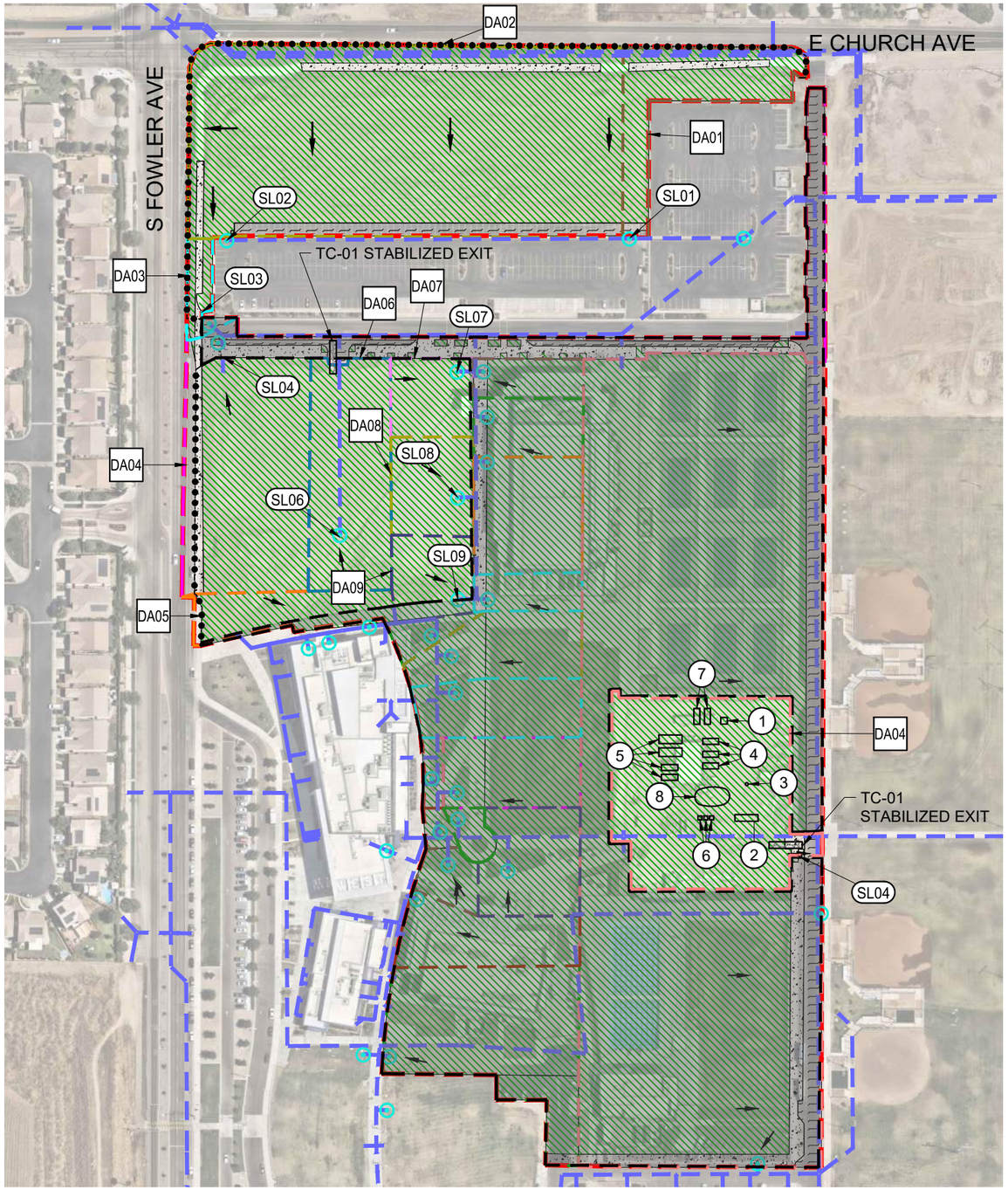
SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
LEGENDS AND NOTES

DR. BY AM
CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 2
OF 5 SHEETS

Drawing: P:\222\222-0322\Site\Exhibits\SWPPP 2022\222322_SangerEd_SWPPP_Figures_COI.dwg; Figure 1B Plot by: amagana Oct 06, 2026 - 11:22am



PRE-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 ASPHALT (NON-ROOF IMPERVIOUS AREAS)
- EXISTING CONCRETE (NON-ROOFTOP IMPERVIOUS AREAS)
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY (MULTIPLE COLORS)
- ## — DRAINAGE AREA NUMBER
- CA## — STORMWATER CONTAINMENT AREA
- CS## — STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- SL## — 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
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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

N

0 50 100 200 300 400
SCALE IN FEET

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 — FIGURE: 2

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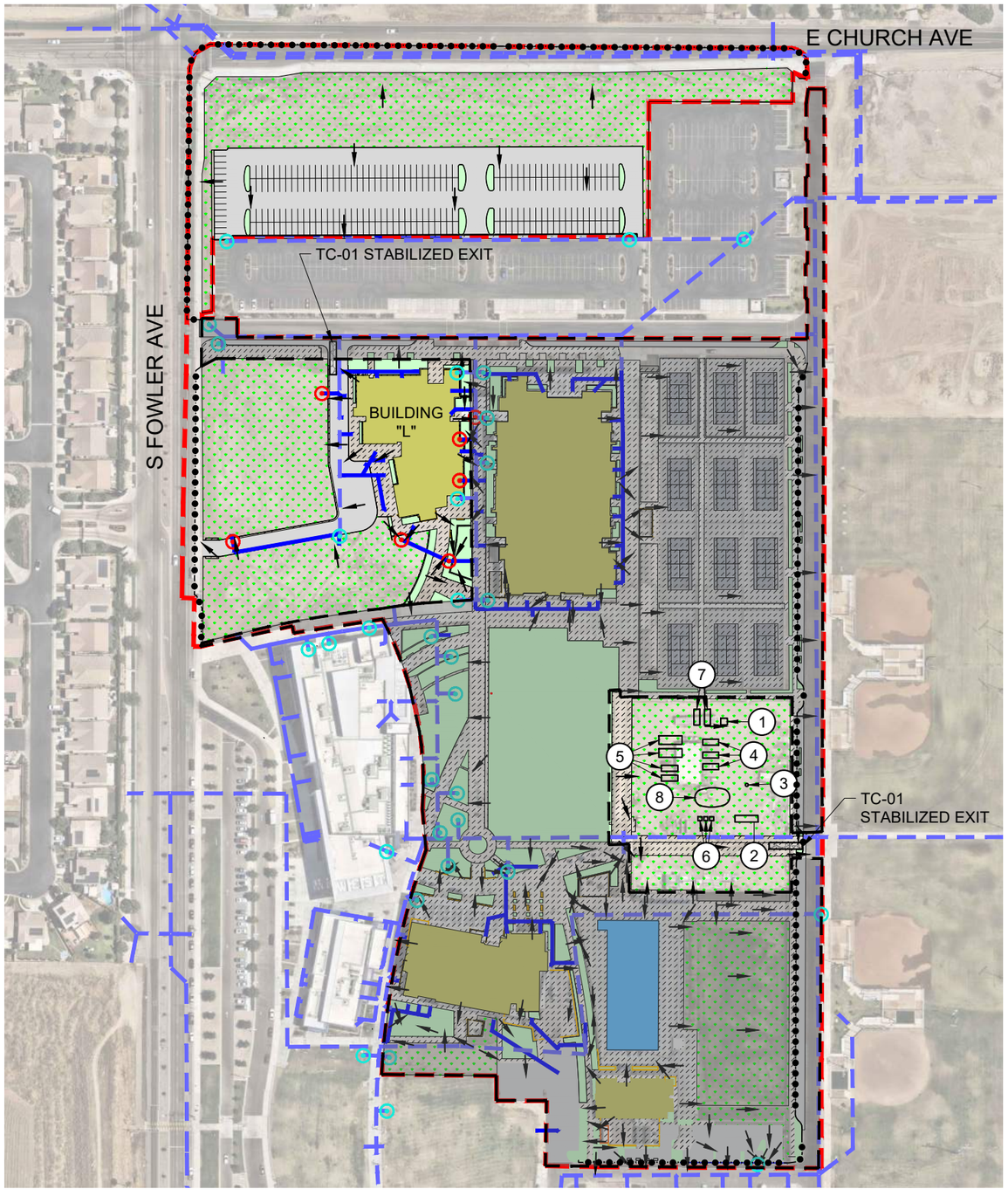
SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
PRE-EARTHWORK SITE MAP

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CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 3
OF 5 SHEETS

Drawing: P:\222\222-0322\Site\Exhibits\SWPPP 2022\222322_SangerEd_SWPPP_Figures_COI.dwg; Figure 2 Plot by: amagana Oct 06, 2026 - 11:22am



CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
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- PROJECT BOUNDARY
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- PROPOSED POOL
- PROPOSED CONCRETE (NON-ROOF IMPERVIOUS AREAS)
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- PROPOSED LANDSCAPING (PERVIOUS AREAS)
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8. STOCKPILE STORAGE LOCATION PER CASQW WM-03

N

0 50 100 200 300 400
SCALE IN FEET

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 | FIGURE: 4

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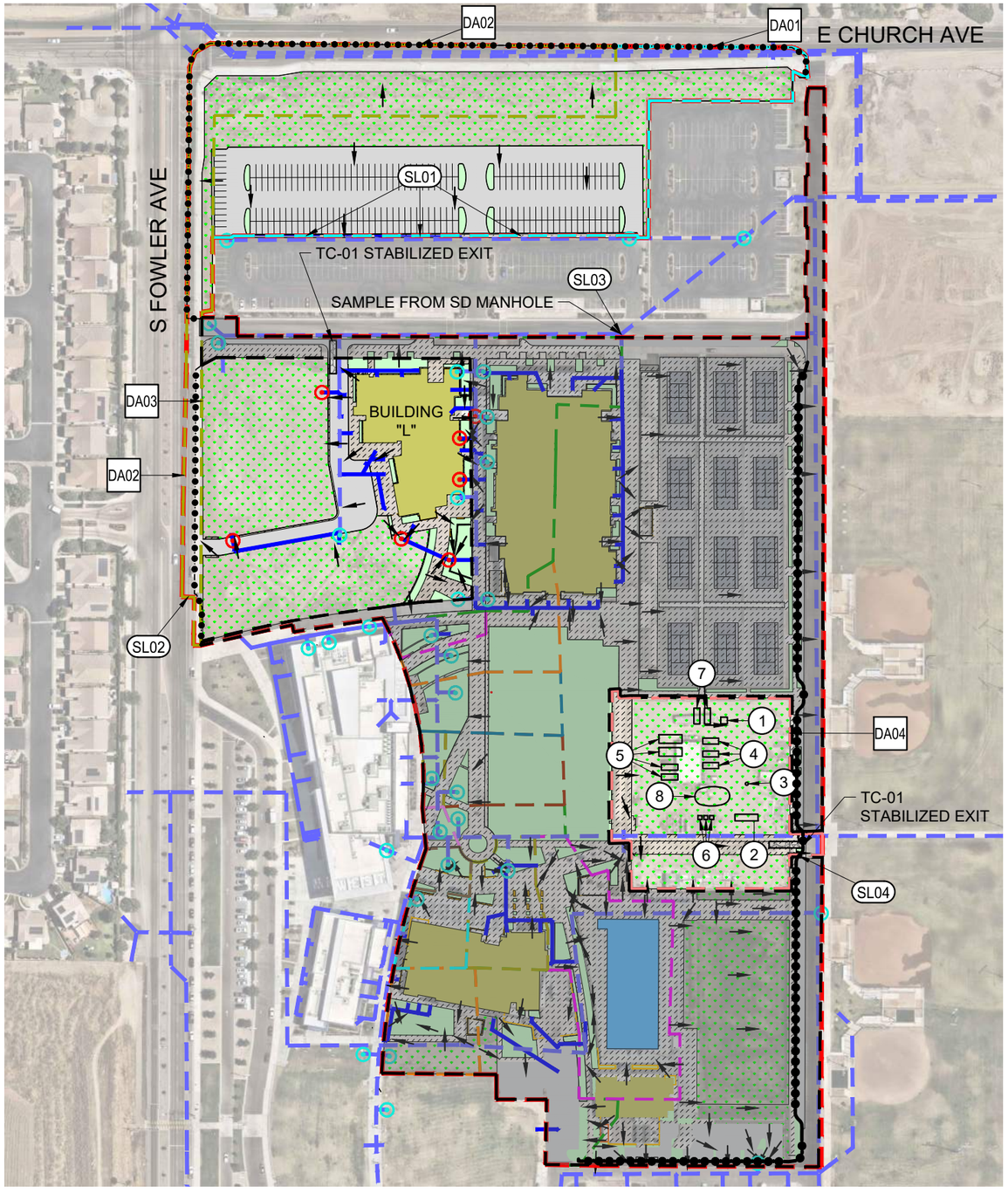
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Fax (559) 326-1300

SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
CONSTRUCTION SITE MAP

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CH. BY GL
DATE 10-05-26
SCALE: AS NOTED

SHEET NO. 4
OF 5 SHEETS



CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
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- PROPOSED STORM DRAIN PIPELINE
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- PROPOSED POOL
- 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 WALL (NON-ROOF IMPERVIOUS AREAS)
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- COMPLETED PHASES OF CONSTRUCTION (BLACK BOUNDARY/GRAY HATCH)

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

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STAGING AREA ITEMS:

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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

N

0 50 100 200 300 400
SCALE IN FEET

SITE LOCATION: 1760 S FOWLER AVE | FRESNO, CA 93727 | 36.7199, -119.68041 FIGURE: 4.i

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SANGER UNIFIED SCHOOL DISTRICT

SWPPP - CHANGE OF INFORMATION
SANGER EDUCATION CENTER - PHASE 3B
DRAINAGE AREA AND SAMPLING SITE MAP - CONSTRUCTION

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DATE 10-05-26
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SHEET NO. 5
OF 5 SHEETS

Appendix B: Permit Registration Documents

Permit Registration Documents included in this Appendix:

Location in SWPPP	**Permit Registration Document** (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	FMFCD Post-Construction Requirements
Appendix L	Post-Construction Compliance Demonstration
Appendix B	Copy of Annual Fee Receipt
N/A	ATS Design Documents, if applicable
N/A	Passive Treatment Design Documents, if applicable

Gavin Newsom
GOVERNOR

Yana Garcia
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Traditional NOI COI

GENERAL PERMIT TO DISCHARGE STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY
(WQ ORDER NO. 2022-0057-DWQ)

COI ID: 120868
Regional Board: Region 5F - Fresno
WDID: 5F10C408288
COI Type: NOI
Owner: Sanger Unified School District
Facility: Sanger Ed Center Phase 3 & Aquatics

Site Info

Field Name	Current Value	Revised Value
Site Name	Sanger Ed Center Phase 3 & Aquatics	
Site Address	1760 Fowler Avenue	
Address Line2		
City	Fresno	
Site Zip Code	93727	
Latitude	36.7119	
Longitude	-119.68041	
Total Site Size	27	
Total Planned Disturbed Acreage	27	
Total Disturbed Area Remaining	27	
Increase in Disturbed Area	N/A	
Decrease in Disturbed Area	N/A	
Tract Number(s)		
Mile Post Marker		
Construction Start Date	November 01, 2025	
Complete Grading Date		
Final Stabilization Date	May 31, 2026	May 31, 2029
Reason for Change	N/A	Extending construction end date to expected end date.

Risk

Field Name	Current Value	Revised Value
R-Factor	121.11	194.83
K-Factor	0.32	0.32
LS-Factor	0.14	0.14
Receiving Water Risk	Low	Low
Combined Risk	Level1	Level1

Inactive Project

Are you looking to inactivate the project? No
Are you looking to reactivate the inactive project? No

Attachments

Attachment ID	File Name	File Hash	File Size	Date Attached	Attachment Type

4158043	Sanger Ed Center Phase 3 & Aquatics - Amendment #1		35794820		SWPPP

Certification

Name: Jimmy Robles
Title: Chief Operations Officer
Date: 06/10/2026

CALIFORNIA Water Boards

Traditional NOI

Gavin Newsom
GOVERNOR

Yana Garcia
SECRETARY FOR
ENVIRONMENTAL PROTECTION

GENERAL PERMIT TO DISCHARGE STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY
(WQ ORDER NO. 2022-0057-DWQ)

WDID: 5F10C408288
Risk Level: Level1

Initial Application Questions

Type: Traditional
Sub-type:
Is the applicant an eligible Discharger as defined in Attachment B (Glossary) for this project? Y
Is the site a part of larger common plan of development? N
Name of the Common Plan of Development:
What is the Total Site Size of the Common Plan of Development?
Is the Construction project separated into phases? N

Owner Information

Owner Name: Sanger Unified School District
Street Address: 1905 7th St
Address Line 2:
City, State, Zip: Sanger, CA, 93657
Title: Chief Operations Officer
Contact Name: Jimmy Robles
Phone Number: 5595247600
Email Address: jimmy_robles@sangerusd.net

On-Site Contact Information

Company Name: Sanger Unified School District
Street Address: 1905 7th St.
Address Line 2:
City, State, Zip: Sanger, CA, 93657
Contact Name: Jimmy Robles
Title: Chief Operations Officer
Phone Number: 5595247600
Email Address: jimmy_robles@sangerusd.net

Site Information

Site Name: Sanger Ed Center Phase 3 & Aquatics
Street Address: 1760 Fowler Avenue
Address Line 2:
City, State, Zip: Fresno, CA, 93727
Latitude: 36.7119
Longitude: -119.68041
Total Site Size: 27
Total Planned Disturbed Acreage: 27
Disturbed Area Remaining: 27
Construction Start Date: 2025-11-01
Complete Grading Date:
Final Stabilization Date: 2026-05-31
Is the site a part of a larger common plan of development? No
Name of Common Plan of Development:
Total Site Size of Common Plan of Development:
Type of Construction: Traditional

Additional Site Information

County: Fresno
Regional Board: Region 5F - Fresno
Regional Water Board Email: r5f_stormwater@waterboards.ca.gov
Receiving Water:
401/404: N
Dewatering: Y
Active Treatment System: N

Passive Treatment Technologies: N
Areas of Special Biological Significance: N

Risk

R-Factor: 121.11
K-Factor: 0.32
LS-Factor: 0.14
Receiving Water Risk: Low
Combined Risk: Level1

TMDL Requirements

There are no TMDL parameters indicated at this time.

Post Construction

Is the project located within a permitted Phase I or Phase II Municipal Separate Storm Sewer System (MS4) area?
Yes
Will the project be subdivided into smaller sub-areas or drainage management areas?

QSD Information

Primary QSD: Michael Gennaro
Other QSD(s):

Attachments

Attachment ID	File Name	File Hash	File Size	Date Attached	Attachment Type
3939325	NOI_COR.zip	4357fc5740d4cf4 07d3afb33b96ad8 1c15186641bf44d 49a6a446bae66b495	36951112		Application COR Zip
3929808	Sanger Ed Center - Phase 3 & Aquatics - SWPPP Figures	71da87ce96dc43d cdc3a2b547fa0d2 6b7853d59a63d8e eb284ac4e8b64c64	6517194		Facility/Site Map
3929807	Sanger Ed Center - Phase 3 & Aquatics - SWPPP	1270df77fffb9f6 7acabe0fa18b8a4 2ed2d12b75fbc76 f99c12dfe35bd75c	28074985		SWPPP
3927029	Sanger Ed Center - Phase 3 & Aquatics - Post Construction Compliance Demonstration	dd3f259ff681f9d d127aaf6792313c 2431624177bdae4 a63ad20e03da8161e	1370644		Post Construction
3927021	FMFCD MS4 - Post-Construction Requirements	5d453294e140a3ec b3fb7ad5a5e3cd24 dfdb13b5466f3ffd 274c374c3f4a53c8	1203712		MS4 Post Construction Reqts

Certification

Name: Jimmy Robles
Title: Chief Operations Officer
Date: 2025-08-13 10:46:28.994

Revised Values

194.83 ? Erosivity Calculator Help

Populate K and LS using GIS layer data

0.32

0.14357778

8.951442840768 Project Sediment Risk Factor: (What's this?) Low

Statewide Map of High Receiving Water Risk Watersheds

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

Receiving Water Risk	Sediment Risk: Low	Sediment Risk: Medium	Sediment Risk: High
Low	Level1	Level2	
High		Level2	Level3

Project Sediment Risk: Low

Project Receiving Water Risk: Low

Project Combined Risk: Level1

An official website of the United States government

MENU

National Pollutant Discharge Elimination System (NPDES)

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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/submitting-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:

11/01/2021

End Date:

10/31/2022

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location:

36.71199,-119.68041

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 11/01/2021	**Latitude:** 36.7120
End Date: 10/31/2022	**Longitude:** -119.6804

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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-cover.pdf>, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT) <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>.Otherwise, you must seek coverage under your state's CGP.

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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.

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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:

11/01/2022

End Date:

10/31/2023

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location:

36.71199,-119.68041

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 11/01/2022	**Latitude:** 36.7120
End Date: 10/31/2023	**Longitude:** -119.6804

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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-cover.pdf>, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT) <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>.Otherwise, you must seek coverage under your state's CGP.

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Rainfall Erosivity Factor Calculator for Small Construction

Introduction

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Steps to Calculate an R Factor for your Small Construction Project

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Start Date:

11/01/2023

End Date:

10/31/2024

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location:

36.71199,-119.68041

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 11/01/2023	**Latitude:** 36.7120
End Date: 10/31/2024	**Longitude:** -119.6804

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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-cover.pdf>, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT) <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>.Otherwise, you must seek coverage under your state's CGP.

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Rainfall Erosivity Factor Calculator for Small Construction

Introduction

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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:

11/01/2024

End Date:

10/31/2025

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location:

36.71199,-119.68041

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 11/01/2024	**Latitude:** 36.7120
End Date: 10/31/2025	**Longitude:** -119.6804

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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-cover.pdf>, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT) <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>.Otherwise, you must seek coverage under your state's CGP.

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Rainfall Erosivity Factor Calculator for Small Construction

Introduction

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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:

11/01/2025

End Date:

05/31/2026

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location:

36.71199,-119.68041

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 11/01/2025	**Latitude:** 36.7120
End Date: 05/31/2026	**Longitude:** -119.6804

Calculation Results

Rainfall erosivity factor (R Factor) = 22.87

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-cover.pdf>, you must submit a Notice of Intent (NOI) through the NPDES eReporting Tool (NeT) <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>.Otherwise, you must seek coverage under your state's CGP.

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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: 05/31/2026

End Date: 05/30/2027

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location: -119.68063385155685 , 36.71243199404

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 05/31/2026	**Latitude:** 36.7124
End Date: 05/30/2027	**Longitude:** -119.6806

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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)

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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: 05/30/2027

End Date: 05/29/2028

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location: -119.68063385155685 , 36.71243199404

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 05/30/2027	**Latitude:** 36.7124
End Date: 05/29/2028	**Longitude:** -119.6806

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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)

An official website of the United States government

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/submitting-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: 05/29/2028

End Date: 05/28/2029

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location: -119.68063385155685 , 36.71243199404

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 05/29/2028	**Latitude:** 36.7124
End Date: 05/28/2029	**Longitude:** -119.6806

Calculation Results

Rainfall erosivity factor (R Factor) = **24.56**

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)

An official website of the United States government

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/submitting-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: 05/28/2029

End Date: 05/31/2029

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location: -119.68063385155685 , 36.71243199404

Search



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 05/28/2029	**Latitude:** 36.7124
End Date: 05/31/2029	**Longitude:** -119.6806

Calculation Results

Rainfall erosivity factor (R Factor) = **0.0354**

A rainfall erosivity factor of less than 5.0 has been calculated for your site and period of construction. 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-cover.pdf>, you can submit a LEW through EPA's NPDES eReporting Tool (NeT) <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-

Appendix C: SWPPP Amendment QSD Certifications

SWPPP Amendment No. 1

Project Name: Sanger Education Center – Phase 3

Project Number: **5F10C408288**

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	06/03/2026 Date
Gabriel Ledesma QSD Name	28909 QSD Certificate Number
Project Environmental Specialist, Blair, Church & Flynn Consulting Engineers Title and Affiliation	559-326-1400 Telephone
451 Clovis Ave., Ste. 200, Clovis, CA 93612 Address	gledesma@bcf-engr.com Email

SWPPP Amendment No. 2

Project Name: Sanger Education Center – Phase 3

Project Number: **5F10C408288**

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."

	10/05/2026
QSD's Signature	Date
Alycia Magana	85204
QSD Name	QSD Certificate Number
Assistant Environmental Specialist, Blair, Church & Flynn Consulting Engineers	559-326-1400
Title and Affiliation	Telephone
451 Clovis Ave., Ste. 200, Clovis, CA 93612	amagana@bcf-engr.com
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	• Adhesives, glues, resins, epoxy synthetics, PVC cement • Caulks, sealers, putty, sealing agents and • Coal tars (naphtha, pitch)	Oil and Grease, Synthetic Organics
Asphalt paving/curbs	• Hot and cold mix asphalt	Oil and Grease
Cleaners	• Polishes (metal, ceramic, tile) • Etching agents • Cleaners, ammonia, lye, caustic sodas, bleaching agents and chromate salts	Metals, Synthetic Organics
Concrete / Masonry	• Cement and brick dust • Colored chalks • Concrete curing compounds • Glazing compounds • Surfaces cleaners • Saw cut slurries • Tile cutting	Metals, Synthetic Organics
Drywall	• Saw-cutting drywall	Metals
Framing/Carpentry	• Sawdust, particle board dust, and treated woods • Saw cut slurries	Metals, Synthetic Organics
Heating, Ventilation, Air Conditioning	• Demolition or construction of air condition and heating systems	Metals, Synthetic Organics
Insulation	• Demolition or construction involving insulation, venting systems	Metals, Synthetic Organics
Liquid waste	• Wash waters • Irrigation line testing/flushing	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
Planting / Vegetation Management	• Vegetation control (pesticides/herbicides) • Planting • Plant maintenance • Vegetation removal	Nutrients, Metals, Synthetic Organics
Plumbing	• Solder (lead, tin), flux (zinc chloride), pipe fitting • Galvanized metal in nails, fences, and electric wiring	Metals, Synthetic Organics

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
Pools/fountains	• Chlorinated water	Synthetic Organics
Removal of existing structures	• Demolition of asphalt, concrete, masonry, framing, roofing, metal structures.	Metals, Oil and Grease, Synthetic Organics
Roofing	• Flashing • Saw cut slurries (tile cutting) • Shingle scrap and debris	Metals, Oil and Grease, Synthetic Organics
Sanitary waste	• Portable toilets • Disturbance of existing sewer lines.	Nutrients
Soil preparation/amendments	• Use of soil additives/amendments	Nutrients
Solid waste	• Litter, trash and debris • Vegetation	Gross Pollutants
Utility line testing and flushing	• Hydrostatic test water • Pipe flushing	Synthetic Organics
Vehicle and equipment use	• Equipment operation • Equipment maintenance • Equipment washing • Equipment fueling	Oil and Grease
Building Demolition	• Demolition debris built between 1950-1980 • Demolition debris from buildings with lead paint	Lead PCBs
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

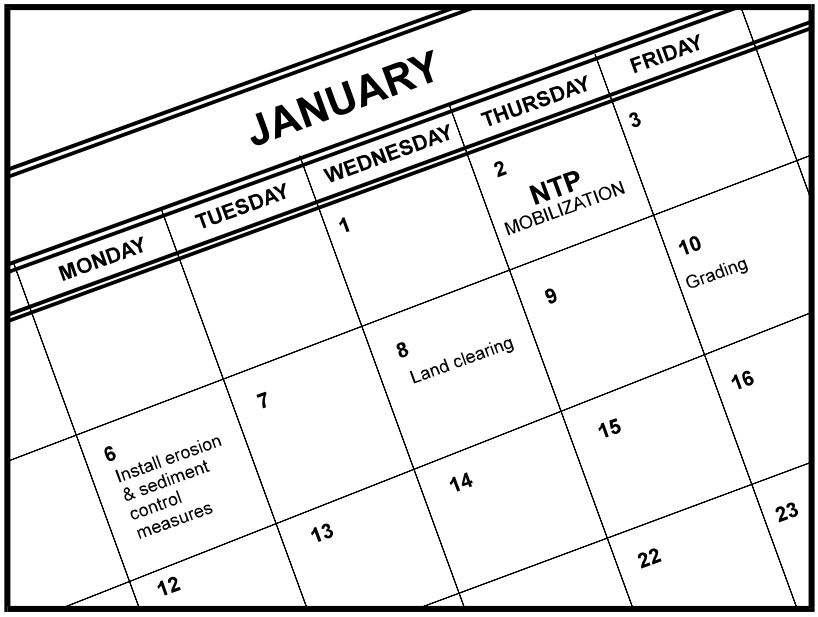
Phase	Activity	Associated Materials or Pollutants	Pollutant Category (1)
Demolition and Pre-Development Site Preparation Phase	Geotechnical investigations	Sediment	TSS
	Vehicle Equipment Operation and Storage	Fuel, Oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	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
	Pools/fountains	Chlorinated water	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

(1) 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

Scheduling EC-1



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	☑
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	☑
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

Scheduling EC-1

should be compared with the other less effective erosion and sedimentation controls to achieve a cost-effective balance.

Inspection and Maintenance

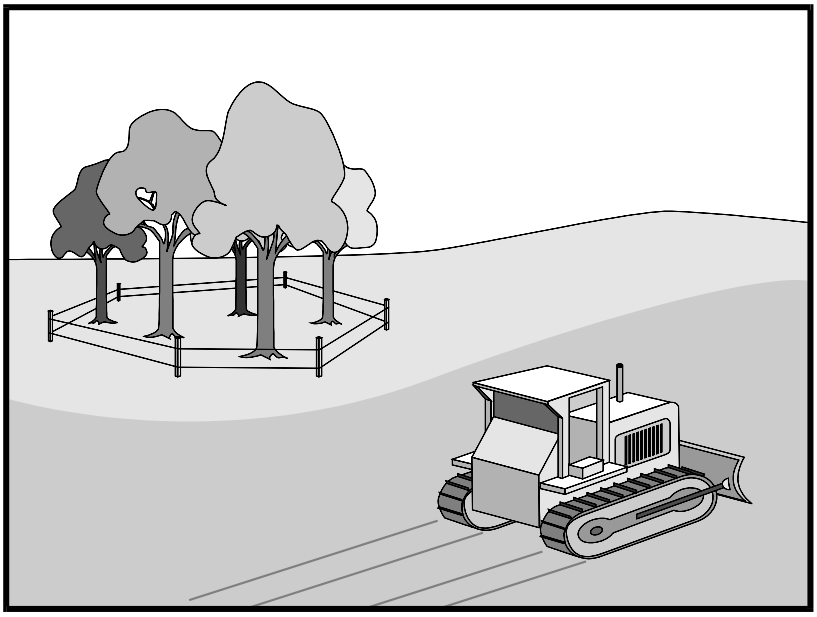
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

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



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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.

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Preservation of Existing Vegetation EC-2

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

- 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 trees 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

- 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

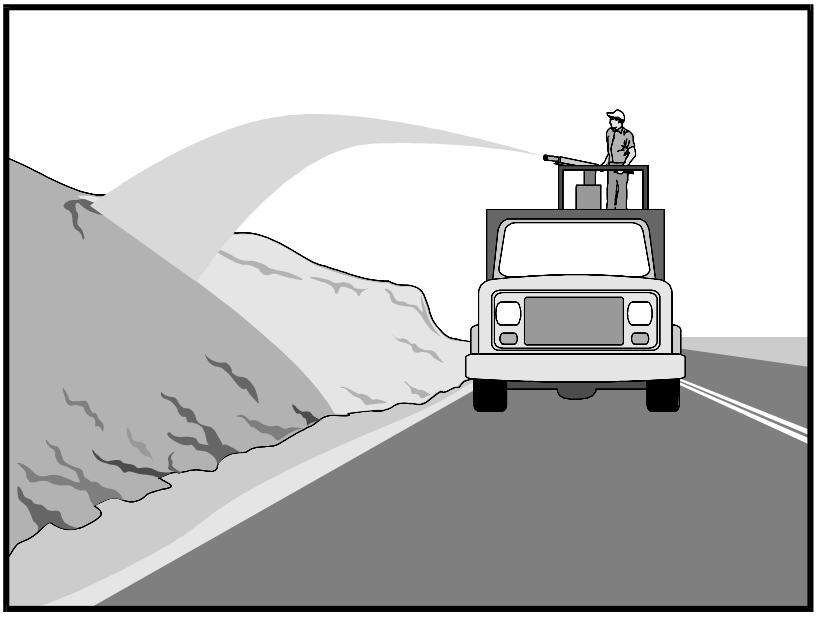
County of Sacramento Tree Preservation Ordinance, September 1981.

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.

Hydraulic Mulch EC-3



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
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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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

Hydraulic Mulch EC-3

- 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 course 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.).

Hydraulic Mulch EC-3

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

Hydraulic Mulch EC-3

- 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 is provided in Table 1, below.

Hydraulic Mulch EC-3

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.

Hydraulic Mulch EC-3

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

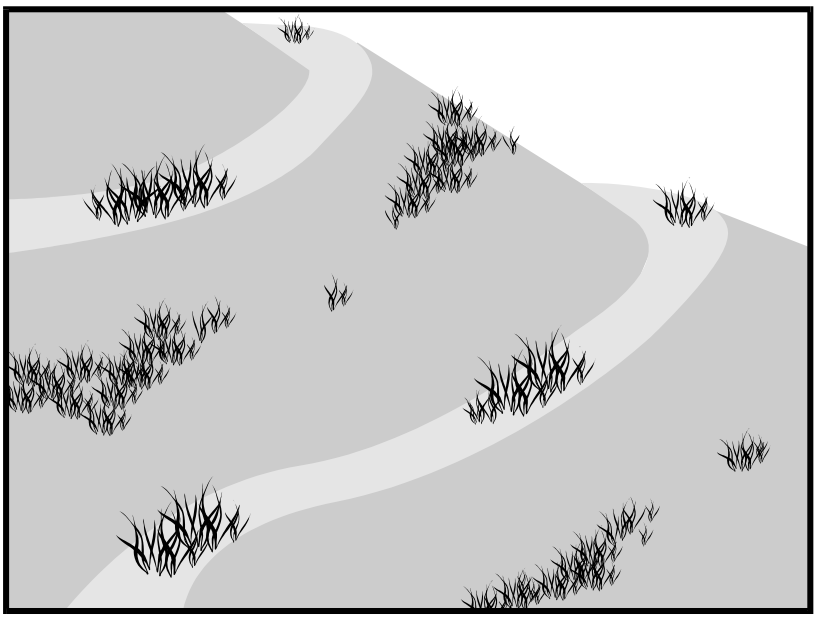
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Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding EC-4



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

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	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
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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Hydroseeding EC-4

- 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:

Hydroseeding EC-4

- 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. 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.

Hydroseeding EC-4

- 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.

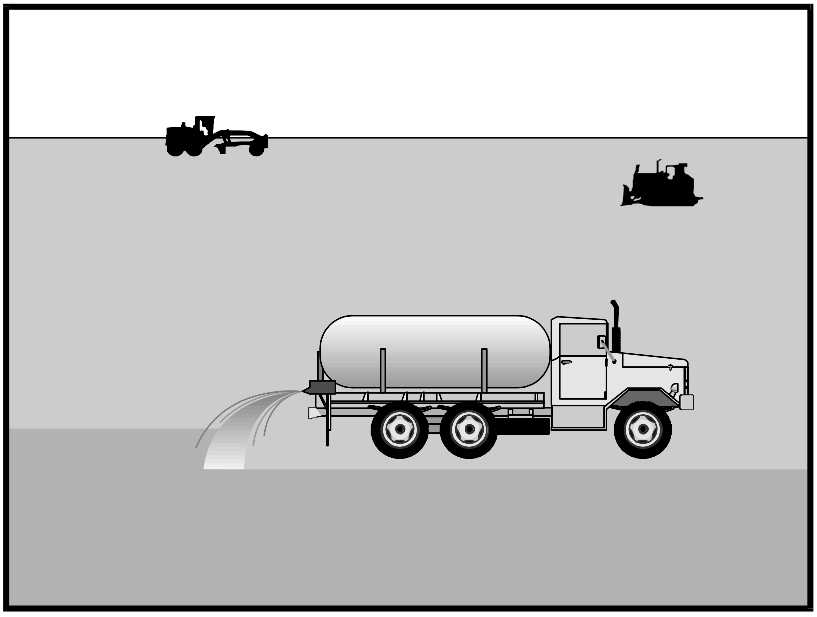
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Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders EC-5



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
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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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.

Soil Binders EC-5

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.

Soil Binders EC-5

- 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:

Soil Binders EC-5

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.

Soil Binders EC-5

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:

Slope Gradient (H:V)	lb/acre
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

Soil Binders EC-5

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 EC-5

- 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^2 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^2.

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.

Soil Binders EC-5

- Reapply the selected soil binder as needed to maintain effectiveness.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	**Plant Material Based (Long Lived)**	**Polymeric Emulsion Blends**	**Cementitious-Based Binders**
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 (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

Soil Binders EC-5

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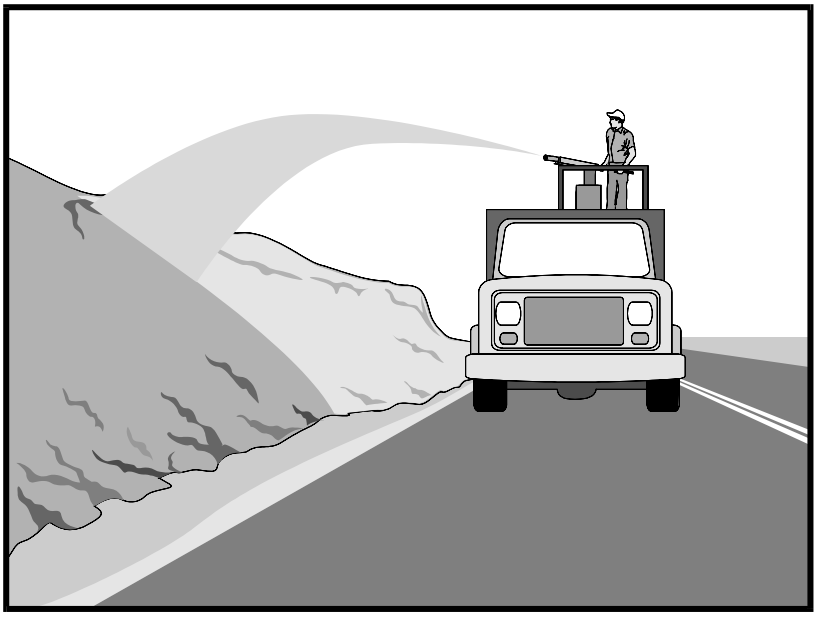
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Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Straw Mulch EC-6



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
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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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.

Straw Mulch EC-6

- 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.

Straw Mulch EC-6

- 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.

Straw Mulch EC-6

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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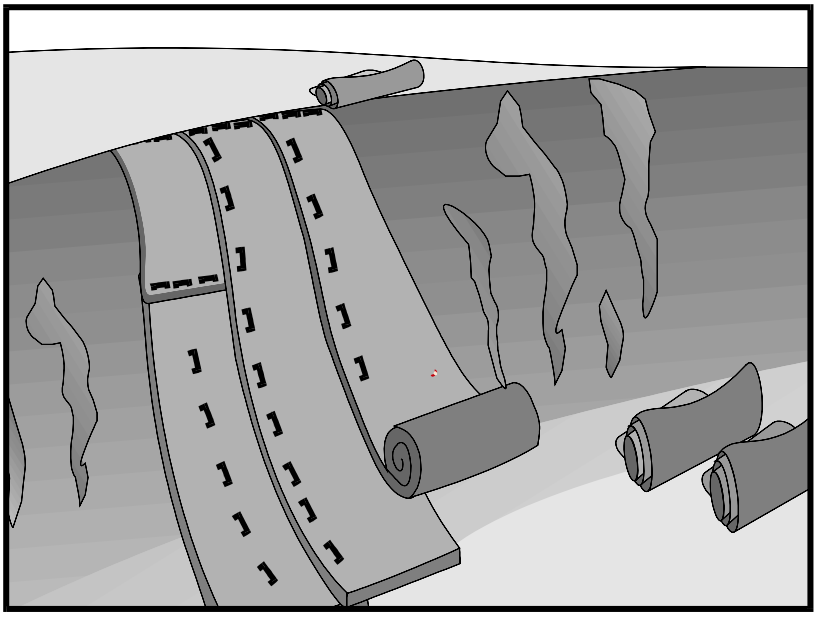
Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

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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.

Geotextiles and Mats EC-7



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. Mattings are 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	☑
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	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

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Geotextiles and Mats EC-7

- 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

Geotextiles and Mats EC-7

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 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

Geotextiles and Mats EC-7

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^2, ±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^2. 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^2. 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^2. 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 ¼ 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.

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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^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2. 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.

Geotextiles and Mats EC-7

- 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 ½-3/4 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.

Geotextiles and Mats EC-7

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.

Geotextiles and Mats EC-7

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.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

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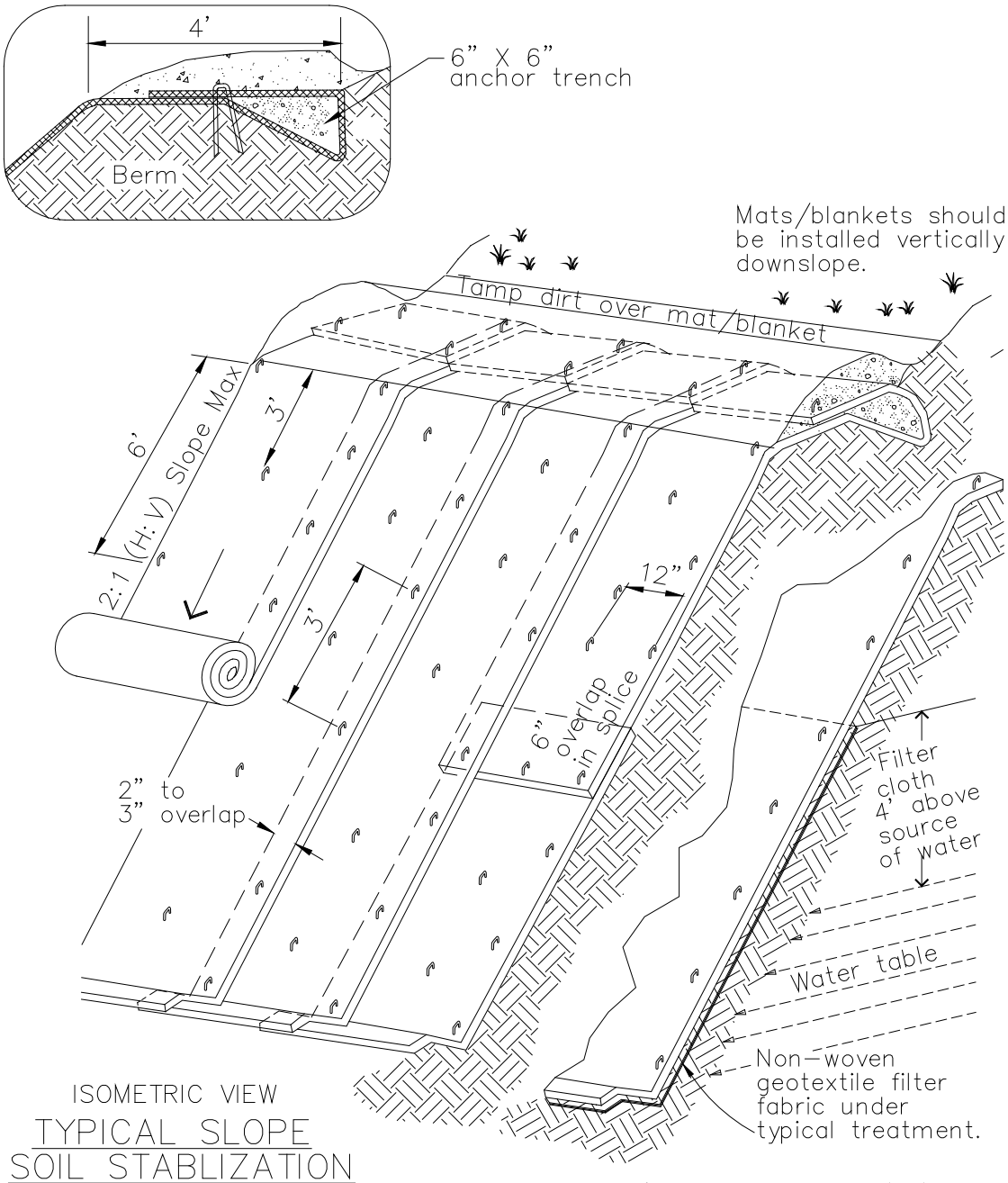
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Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Geotextiles and Mats EC-7



ISOMETRIC VIEW

TYPICAL SLOPE
SOIL STABLIZATION
NTS

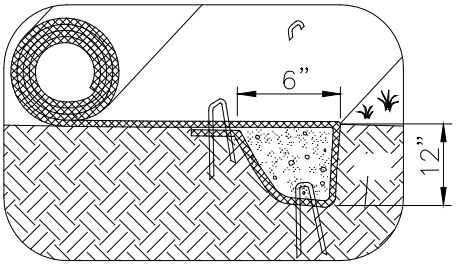
WET SLOPE LINING
NTS

NOTES:

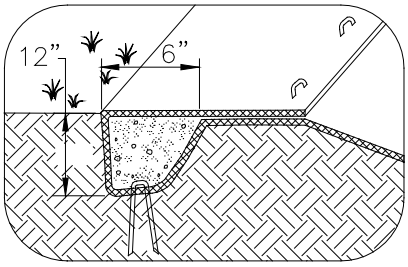
1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL

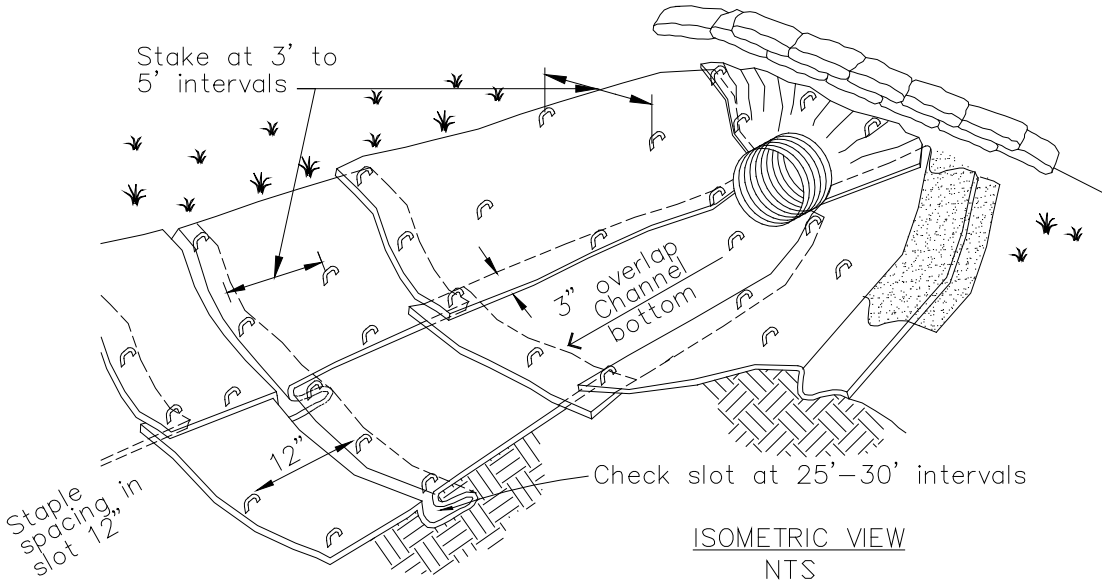
Geotextiles and Mats EC-7



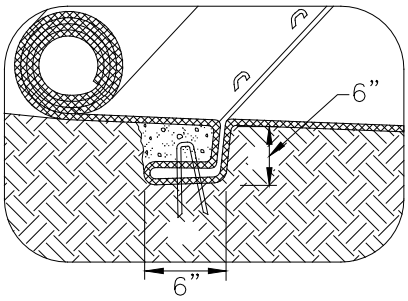
INITIAL CHANNEL ANCHOR TRENCH
NTS



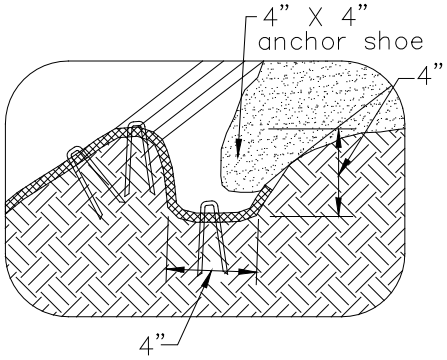
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
NTS



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

Wood Mulching EC-8



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
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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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.

Wood Mulching EC-8

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[1]. 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.

[1] 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) and adjusted for inflation from 1997 to 2016.

Wood Mulching EC-8

- 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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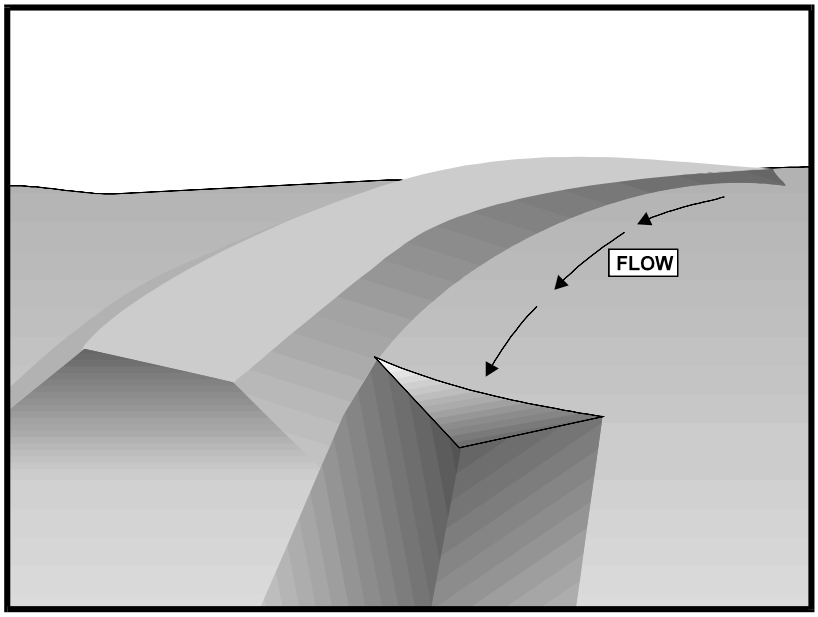
Soil Erosion by Water Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Soil Stabilization BMP Research for Erosion and Sediment Controls Cost Survey Technical Memorandum, CTSW-TM-07-172.35.1, California Department of Transportation (Caltrans), July 2007. Available online at: http://www.dot.ca.gov/hq/LandArch/16_la_design/guidance/estimating/Soil_Stabilization_Pricing.pdf.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Earth Dikes and Drainage Swales EC-9



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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

Earth Dikes and Drainage Swales EC-9

- Along roadways and facility improvements subject to flood drainage
- At the top of slopes to divert runon 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%.

Earth Dikes and Drainage Swales EC-9

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.

Earth Dikes and Drainage Swales EC-9

- 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 %.

Earth Dikes and Drainage Swales EC-9

- 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^3 (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.

Earth Dikes and Drainage Swales EC-9

- 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

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Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

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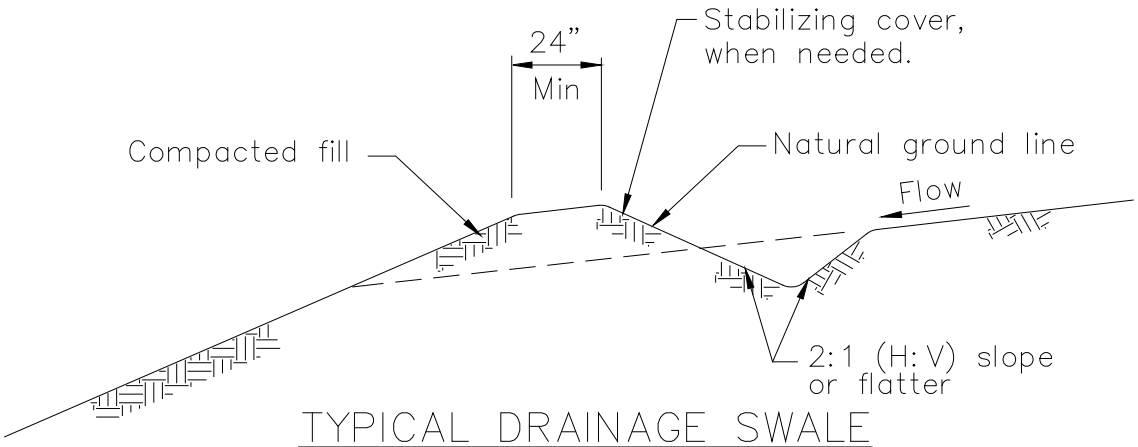
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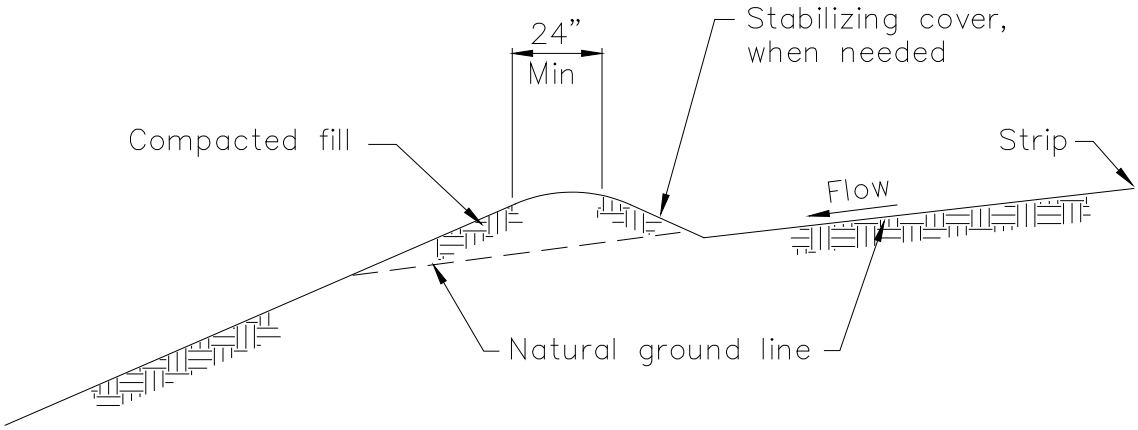
Earth Dikes and Drainage Swales EC-9



TYPICAL DRAINAGE SWALE
NOT TO SCALE

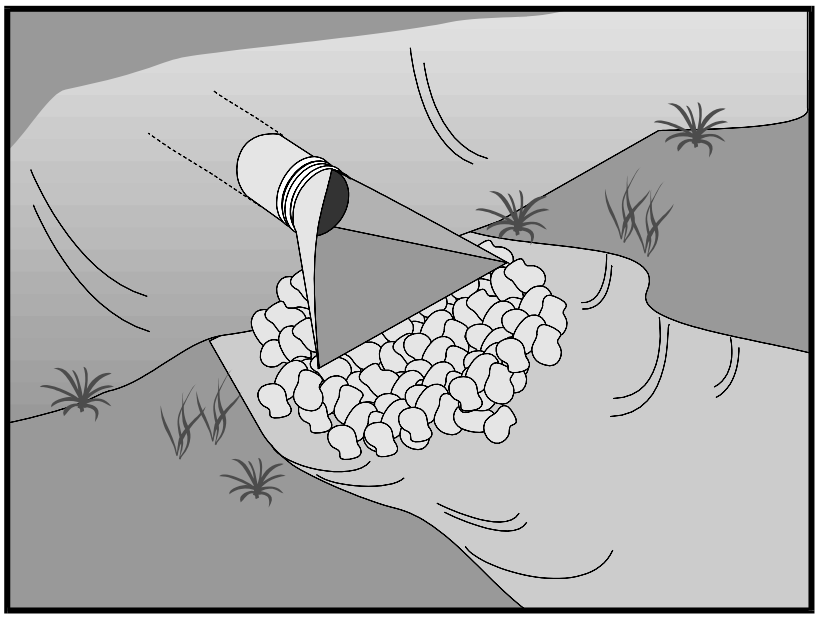
NOTES:

1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.



TYPICAL EARTH DIKE
NOT TO SCALE

Velocity Dissipation Devices EC-10



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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 runon 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.

Velocity Dissipation Devices EC-10

- 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 (plange 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.

Velocity Dissipation Devices EC-10

- 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.

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Velocity Dissipation Devices EC-10

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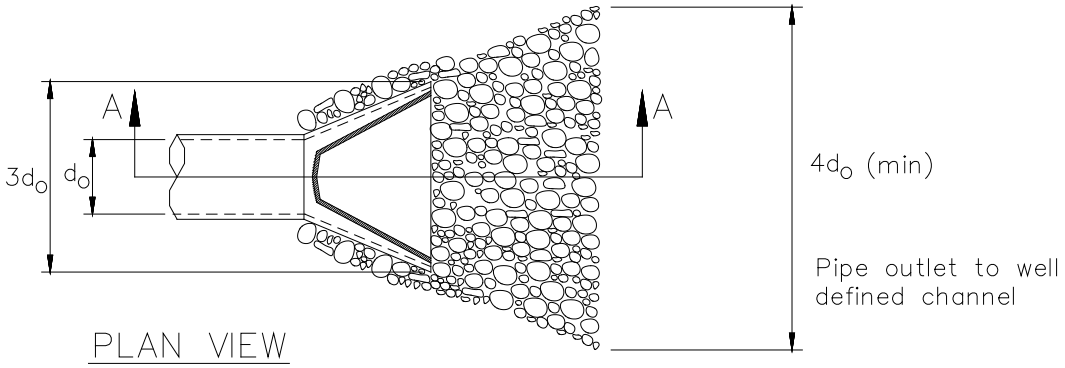
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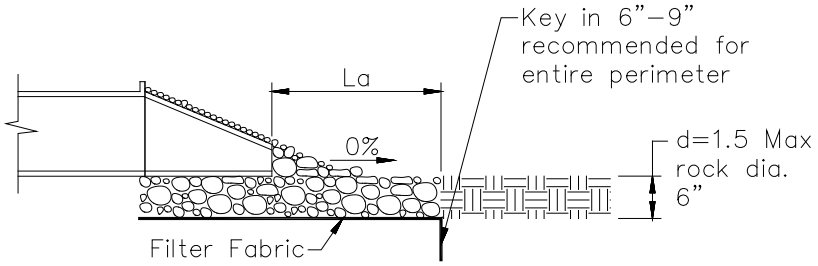
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Velocity Dissipation Devices EC-10



PLAN VIEW

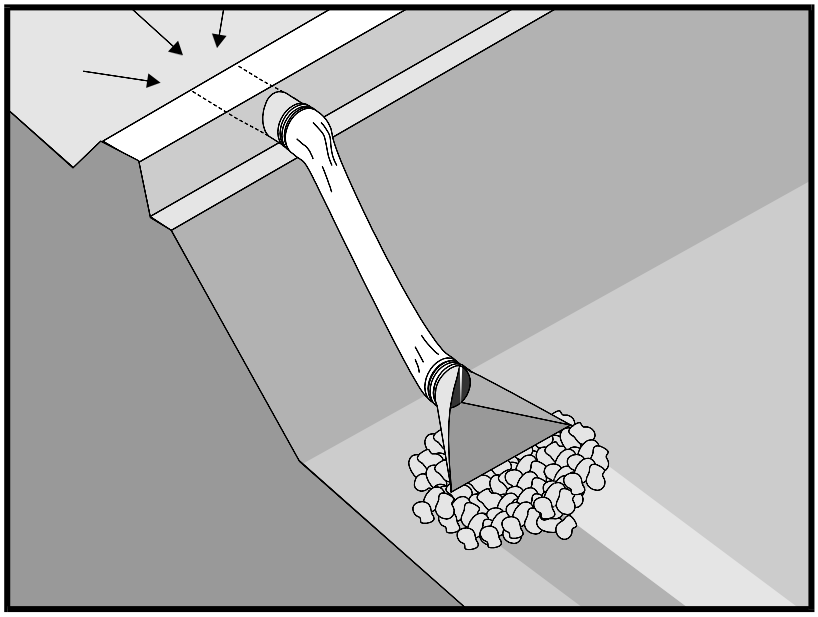


SECTION A–A

Pipe Diameter inches	Discharge ft³/s	Apron Length, La ft	Rip Rap D_{50} 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

Slope Drains EC-11



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

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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.

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Slope Drains EC-11

  - 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 downdrain 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.

Slope Drains EC-11

- 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:

Slope Drains EC-11

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.

Slope Drains EC-11

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.

Slope Drains EC-11

- 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.

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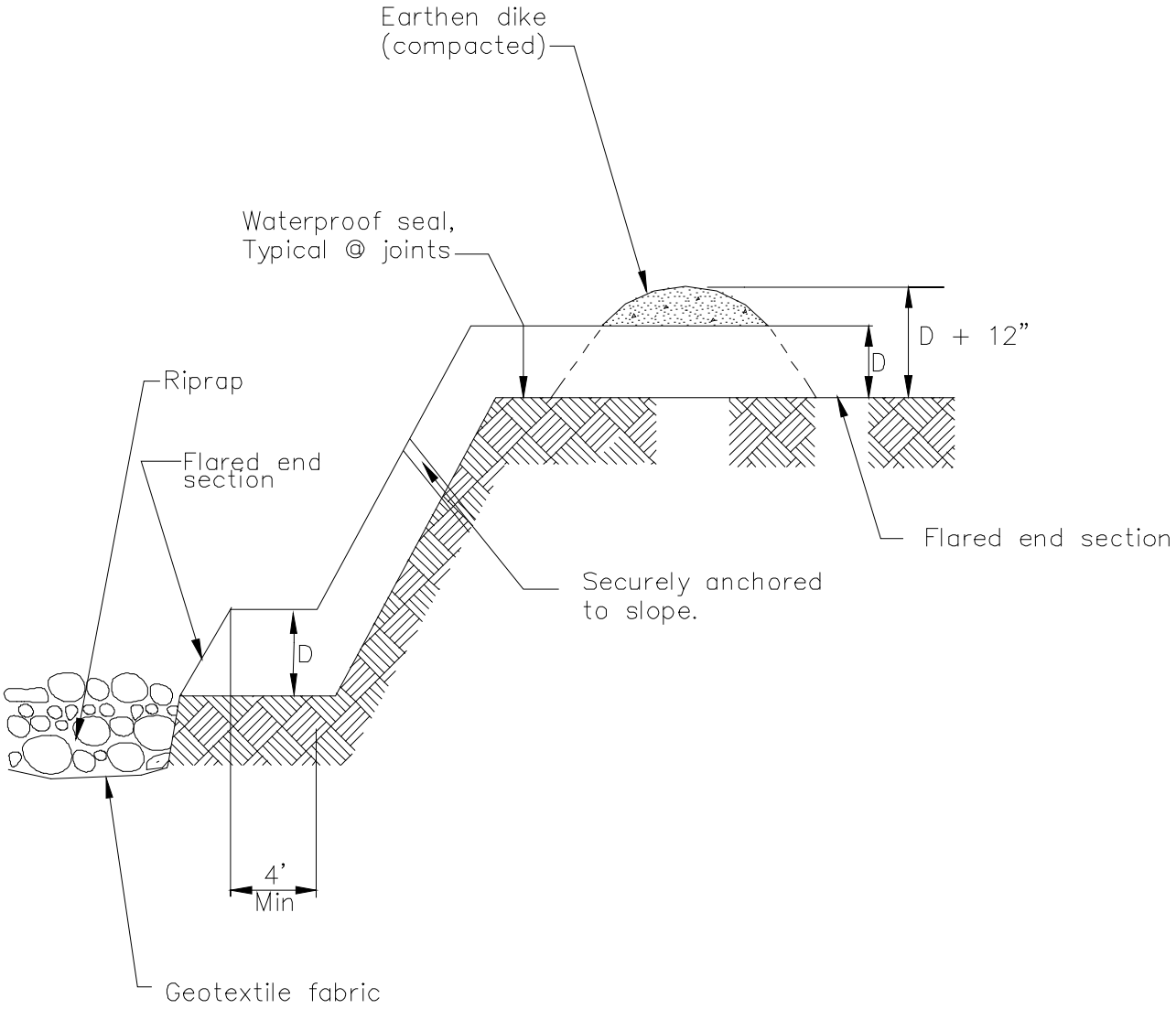
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Slope Drains EC-11



TYPICAL SLOPE DRAIN
NOT TO SCALE

Streambank Stabilization EC-12



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

Combination of erosion and sediment controls.

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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

Streambank Stabilization EC-12

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.

Streambank Stabilization EC-12

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^2, 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 EC-12

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.

Streambank Stabilization EC-12

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.

Streambank Stabilization EC-12

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.

Streambank Stabilization EC-12

- **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).

Streambank Stabilization EC-12

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

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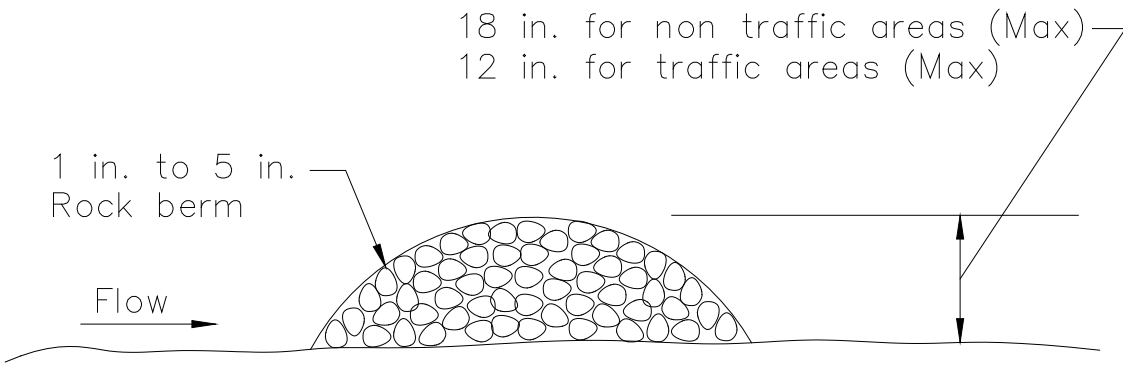
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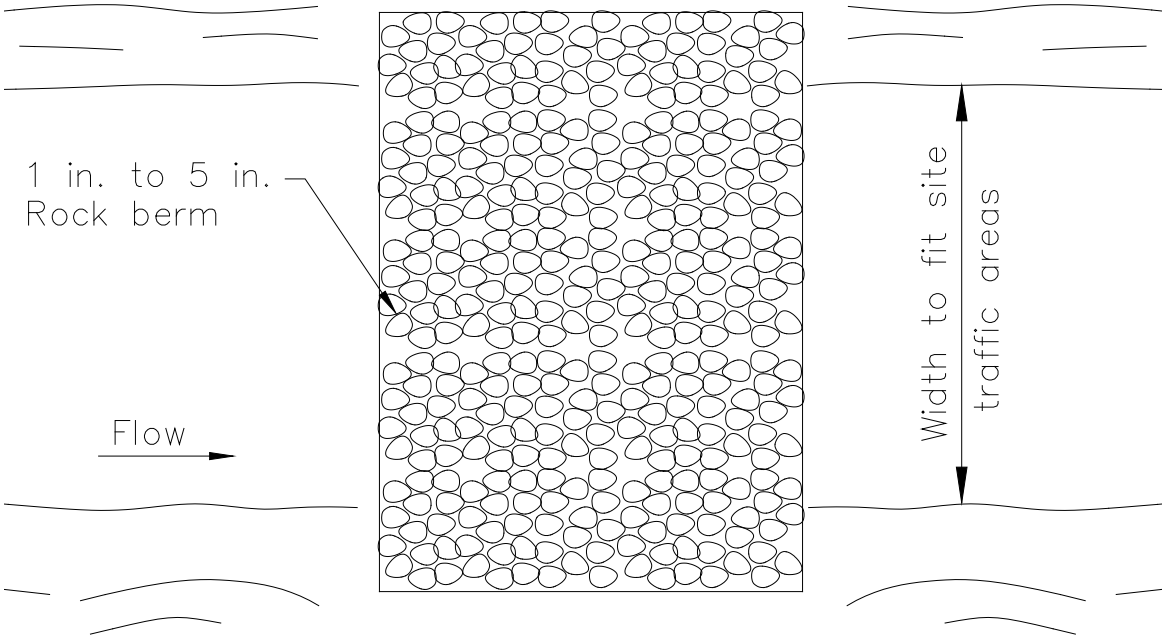
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Streambank Stabilization EC-12



SECTION



PLAN

TYPICAL ROCK FILTER
NOT TO SCALE

Compost Blanket EC-14



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	☑
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	☑
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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Compost Blanket EC-14

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 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.

Compost Blanket EC-14

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.

Compost Blanket EC-14

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_2-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

Compost Blanket EC-14

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.

Compost Blanket EC-14

- 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.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, pubs.caes.uga.edu/caespubs/pubcd/B1200.htm, Faucette, B. and Risse, M., 2009.

Demonstration Project Using Yard Debris Compost for Erosion Control, Final Report, presented to Metropolitan Service District, W&H Pacific, 1993.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, 2005.

Standard Special Provision 10-1, Erosion Control (Compost Blanket), California Department of Transportation (Caltrans). 2007 Update.

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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, 2009.

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.

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.

Soil Preparation/Roughening EC-15



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	☑
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	☑
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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Soil Preparation/Roughening EC-15

- 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.

Soil Preparation/Roughening EC-15

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.

Soil Preparation/Roughening EC-15

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.

Non-Vegetative Stabilization EC-16



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	☑
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	☒
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Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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Non-Vegetative Stabilization EC-16

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.

Non-Vegetative Stabilization EC-16

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.

Non-Vegetative Stabilization EC-16

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^2 in flat areas and \$14 - \$30/yd^2 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.

Non-Vegetative Stabilization EC-16

- Should remain stable under loose surface material. Any significant problem areas should be repaired to restore uniformity to the installation.

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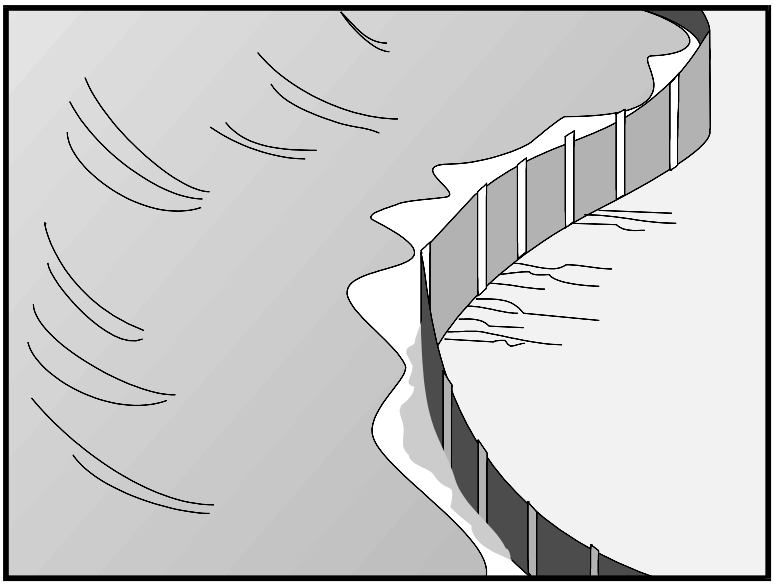
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Silt Fence SE-1



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

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.

Targeted Constituents	
Sediment (coarse sediment)	☑
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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Silt Fence SE-1

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.^{2} 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)

Silt Fence SE-1

- 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.^{2} 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.

Silt Fence SE-1

- 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 1/3 the height of the barrier; in no case should the reach exceed 500 ft.

- Cross barriers should be a minimum of 1/3 and a maximum of ½ the height of the linear barrier.

- See typical installation details at the end of this fact sheet.

Silt Fence SE-1

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 Fence SE-1

- 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.

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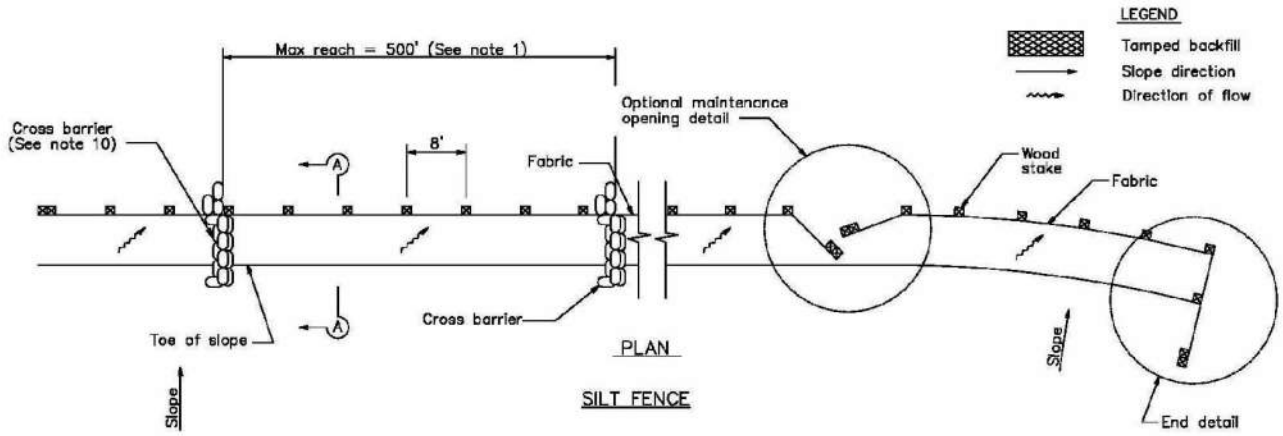
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Silt Fence SE-1

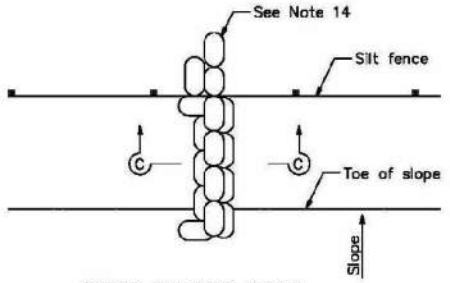
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Silt Fence SE-1

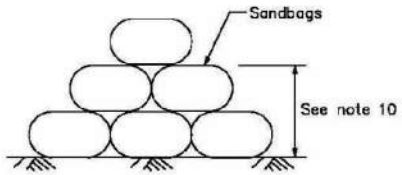


NOTES

1. 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'.
2. The last 8'–0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 8'–0" maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. 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.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.
14. 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.

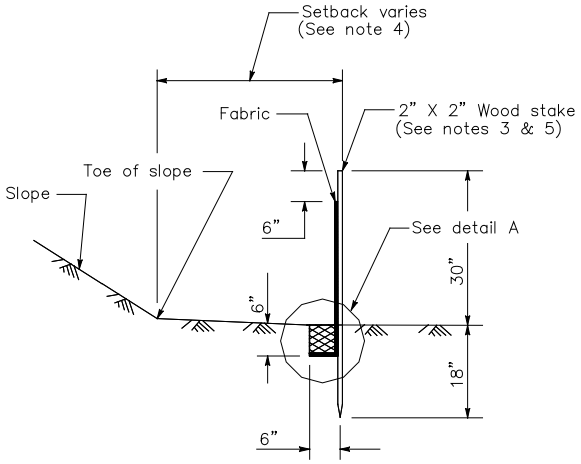


CROSS BARRIER DETAIL

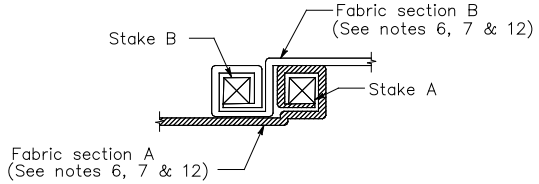


SECTION C–C

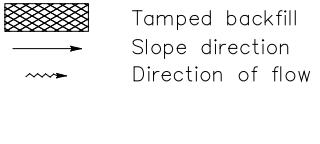
Silt Fence SE-1

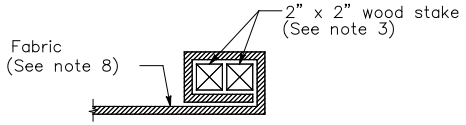


SECTION A–A

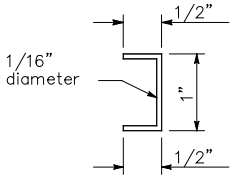


JOINING SECTION DETAIL (TOP VIEW)

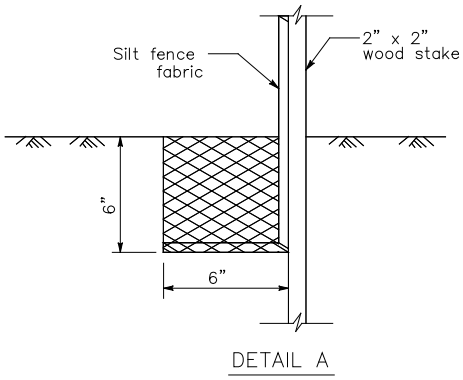




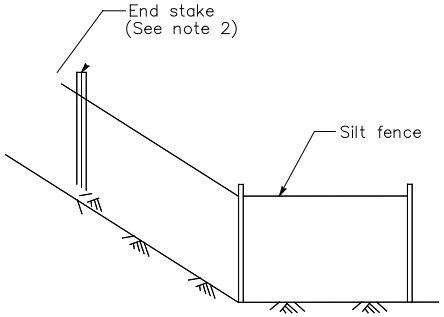
END STAKE DETAIL (TOP VIEW)



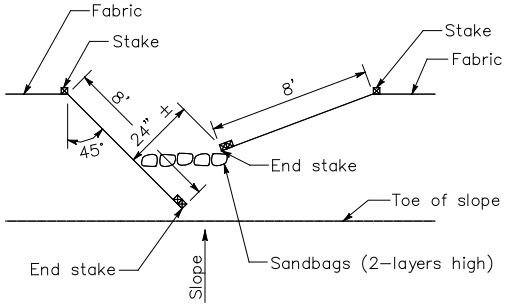
STAPLE DETAIL
(SEE NOTE 9)



DETAIL A

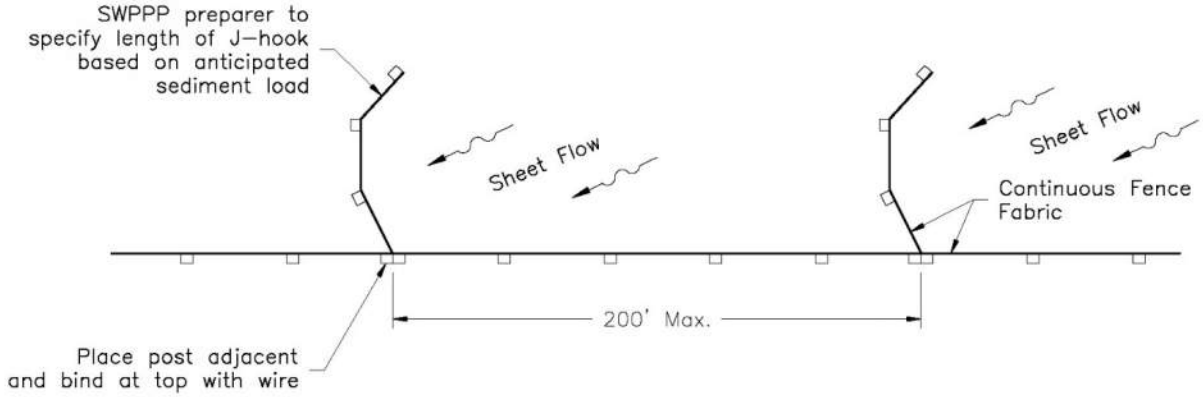


END DETAIL



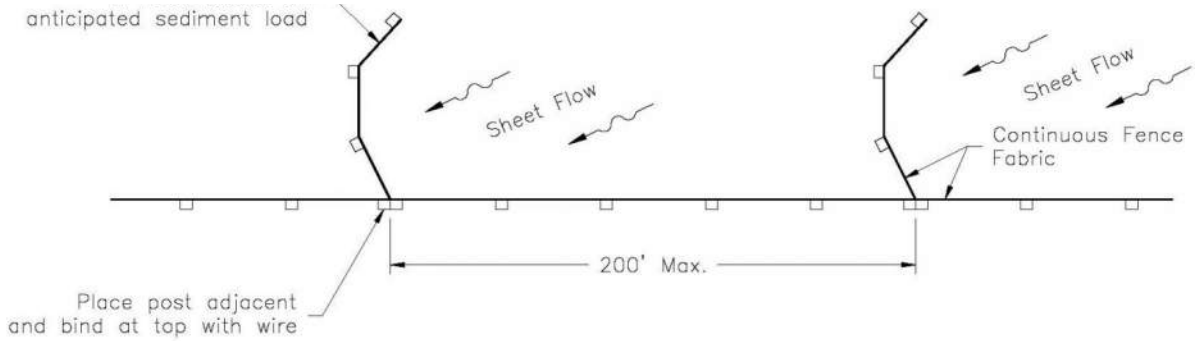
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)

Silt Fence SE-1



Plan

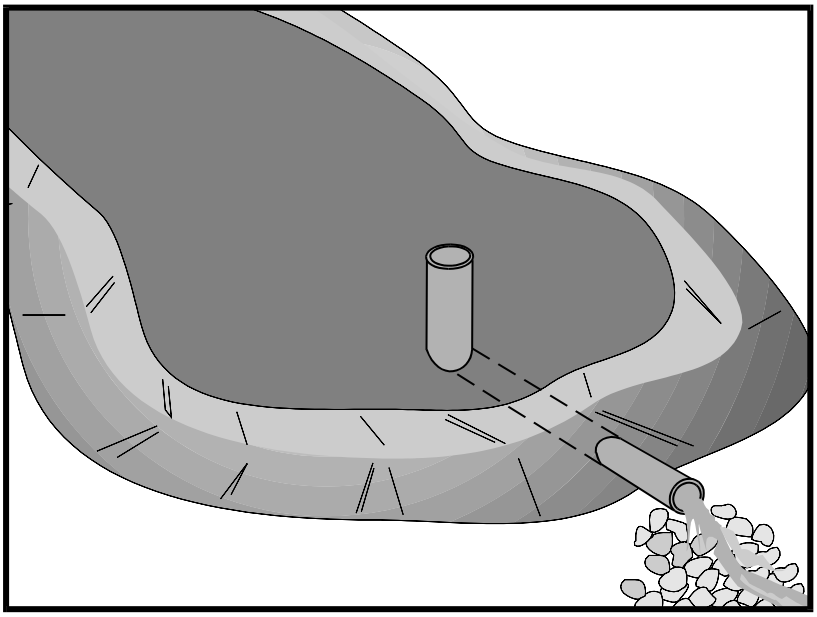
J–HOOK



Plan

J–HOOK

Sediment Basin SE-2



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

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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

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Sediment Basin SE-2

(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/).

Sediment Basin SE-2

- 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.

Sediment Basin SE-2

- 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:

$$A_s = \frac{1.2Q}{V_s} \qquad \text{(Eq. 1)}$$

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.

Sediment Basin SE-2

$Q = CIA$ (Eq.2)

Where

Q = Peak basin influent flow rate measured in cubic feet per second (ft^3/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.

Sediment Basin SE-2

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 Vs is estimated using Stokes Law presented in Equation 3.

$$V_s = 2.81d^2 \qquad \text{(Eq.3)}$$

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 verses 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).

Sediment Basin SE-2

- 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:

$$Q = BC' A(2gH)^{0.5} \qquad \text{(Eq.4)}$$

Where
Q = Outflow rate in ft^3/s
C′ = Orifice coefficient (unitless)
A = Area of the orifice (ft^2)
g = acceleration due to gravity (ft^3/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.

$$A = R \times K \times LS \times C \times P \qquad \text{(Eq.5)}$$

$$Y = 95\left(Q \times q_p\right)^{0.56} \times K \times LS \times C \times P \qquad \text{(Eq.6)}$$

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.

Sediment Basin SE-2

  - 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.

Sediment Basin SE-2

- 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^3, 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.

Sediment Basin SE-2

- 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.

Sediment Basin SE-2

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Sediment Basin SE-2

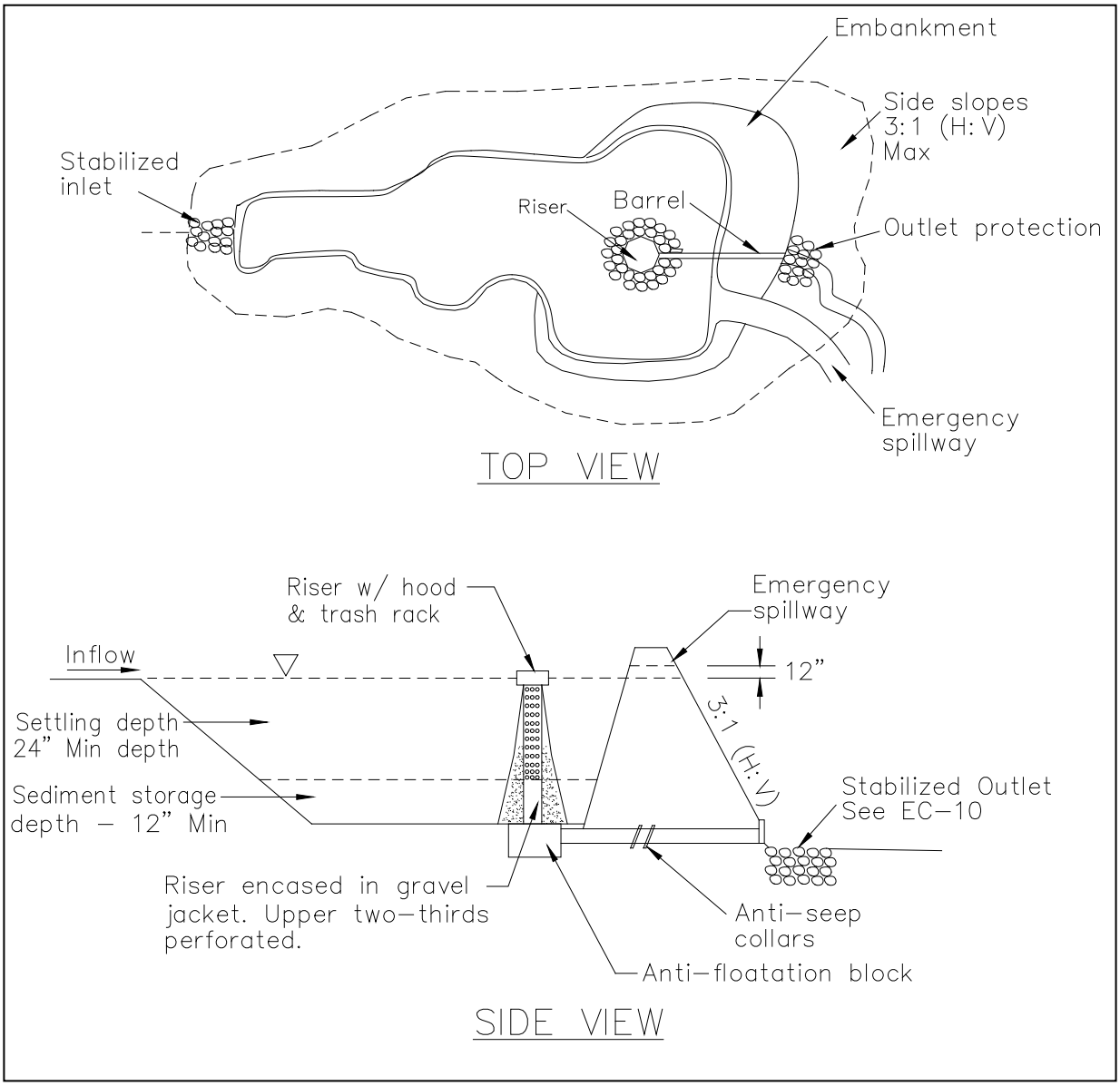


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
MULTIPLE ORIFICE DESIGN
NOT TO SCALE

Sediment Basin SE-2

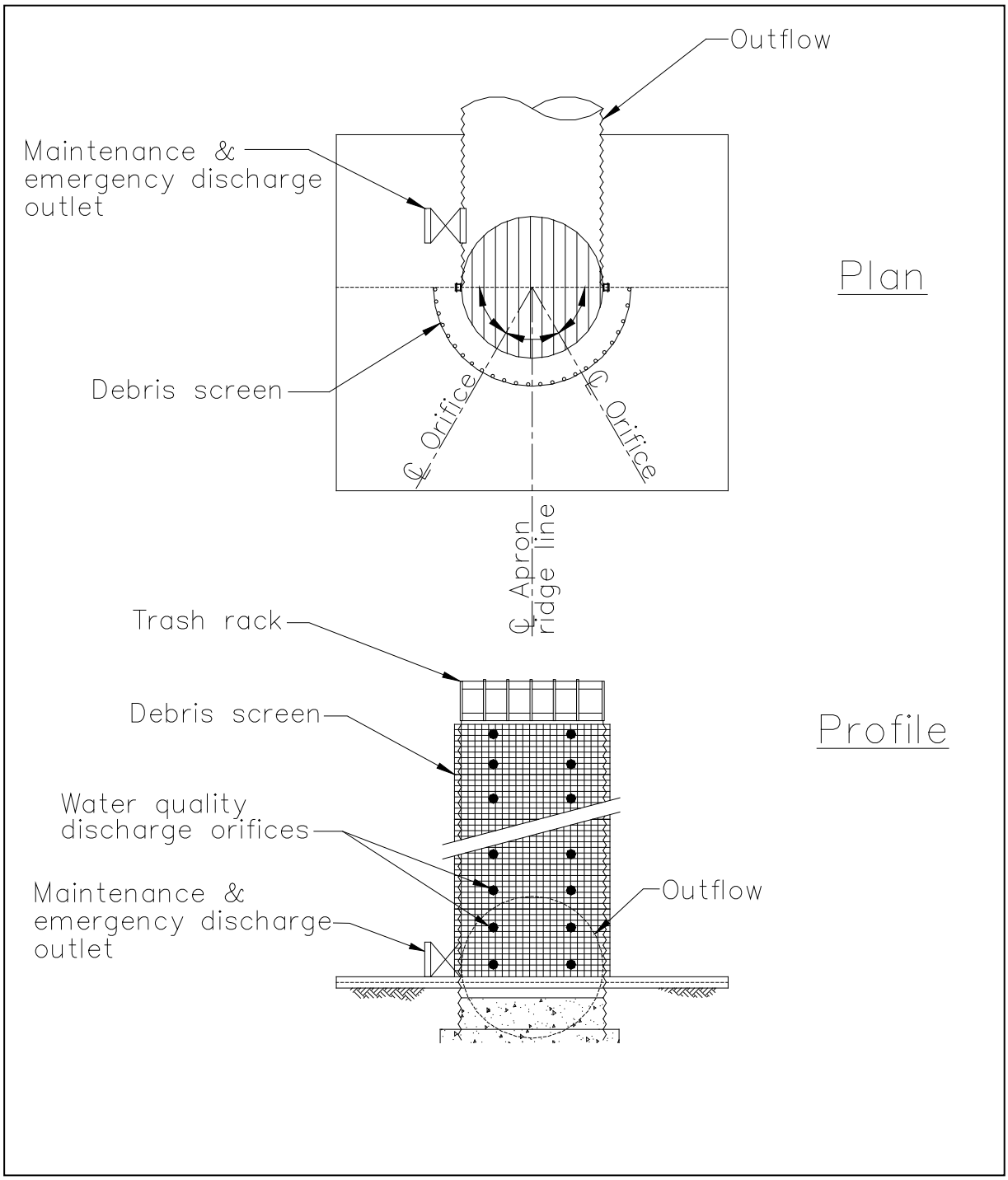


FIGURE 2: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

Sediment Basin SE-2

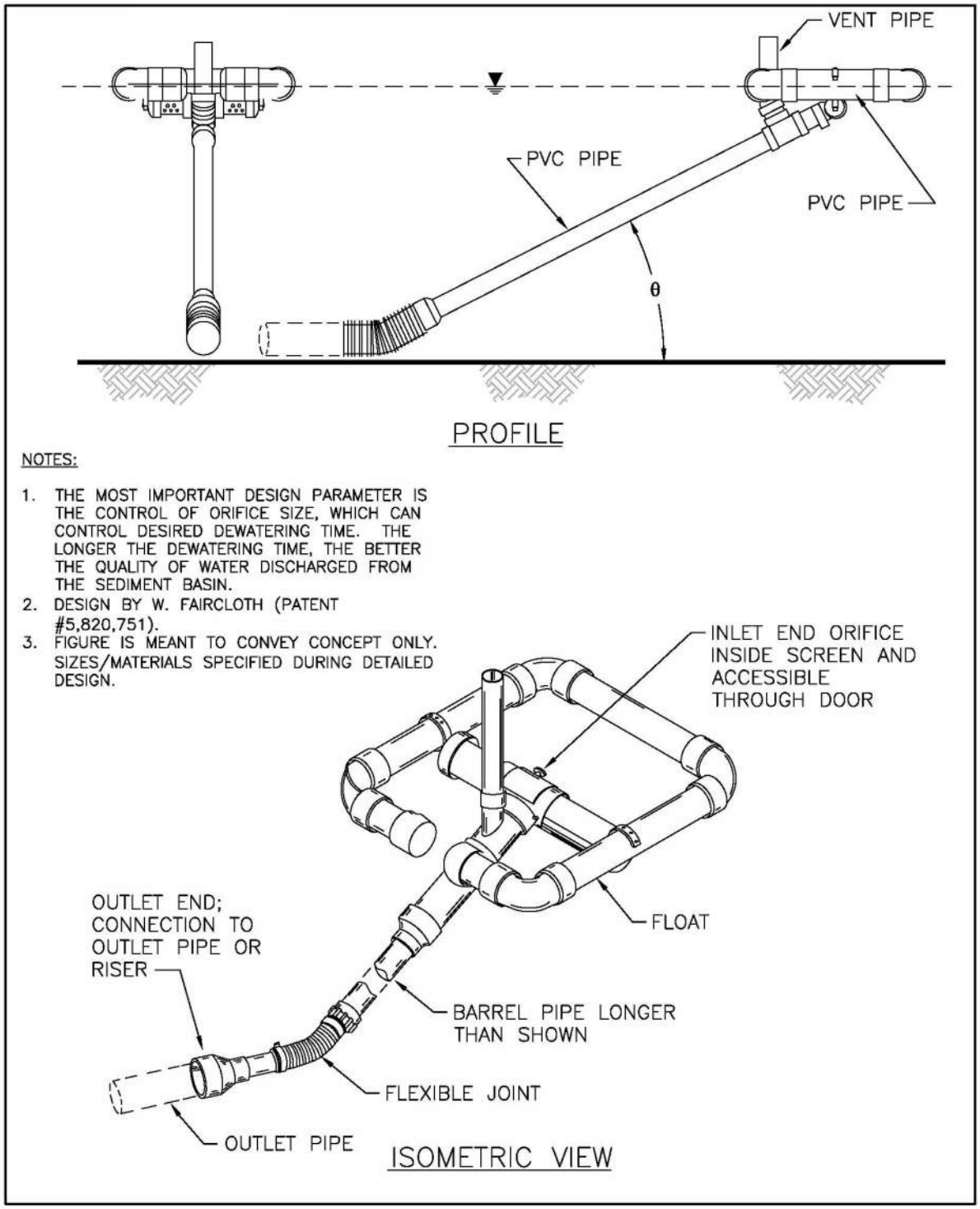


FIGURE 3: TYPICAL SKIMMER

NOT TO SCALE

Sediment Basin SE-2

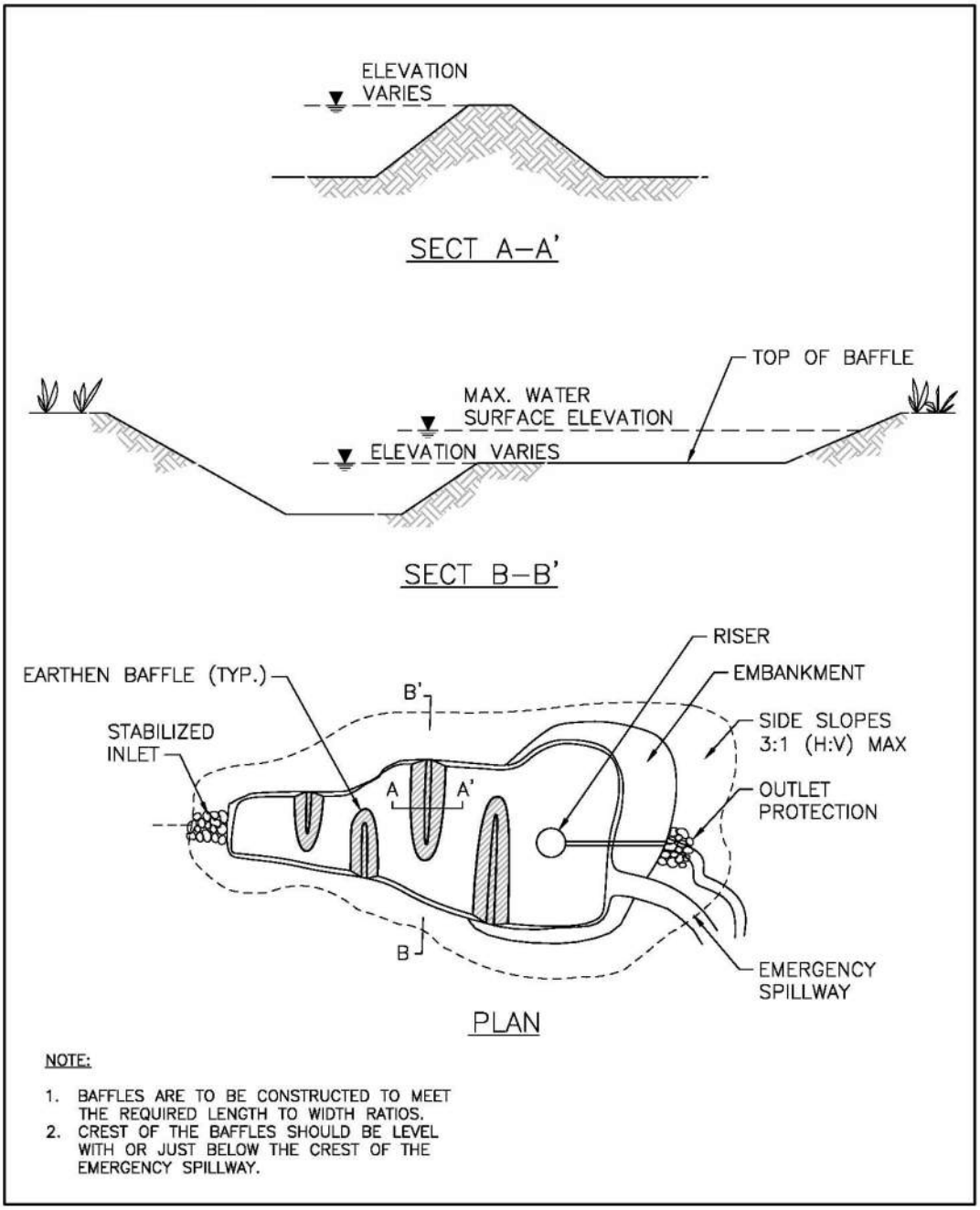
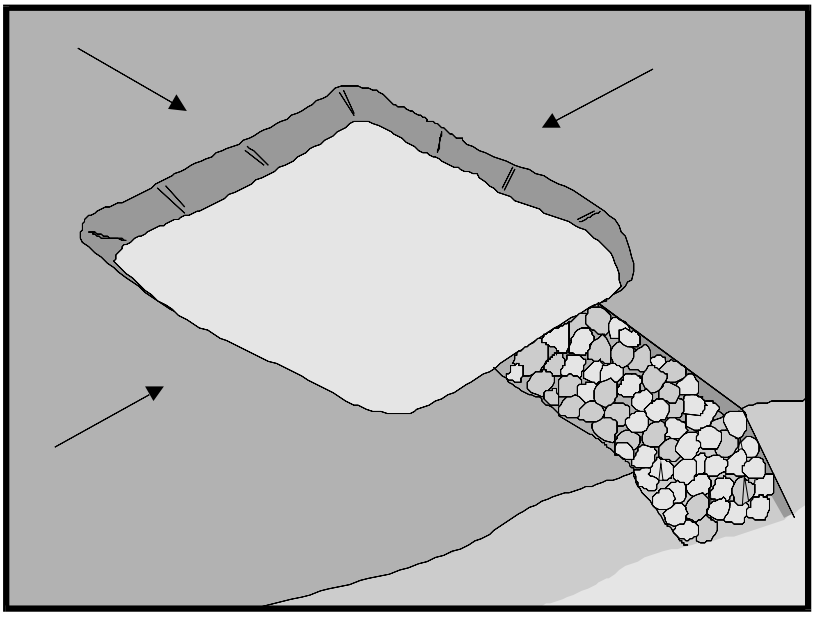


FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN WITH BAFFLES

NOT TO SCALE

Sediment Trap SE-3



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

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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

Sediment Trap SE-3

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

Sediment Trap SE-3

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^3/acre and 33 yd^3/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^3, 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.

Sediment Trap SE-3

- 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 ^{2} 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.

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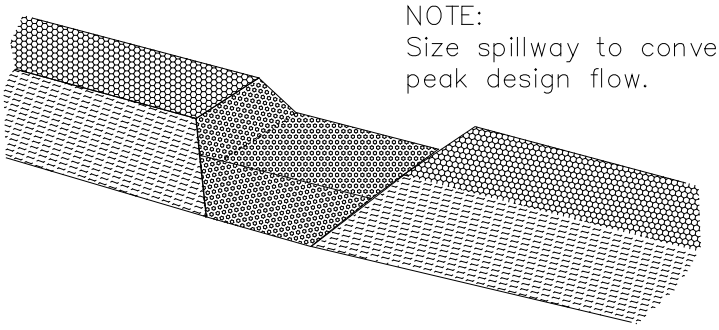
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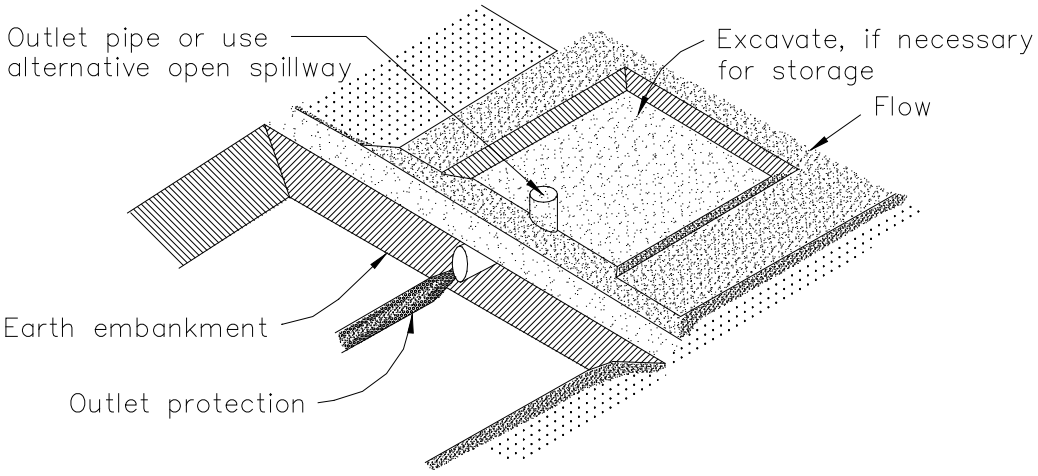
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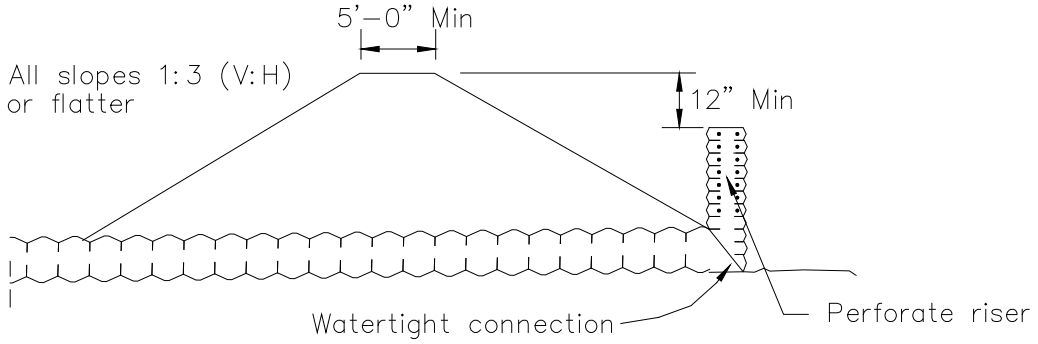
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Sediment Trap SE-3



TYPICAL OPEN SPILLWAY

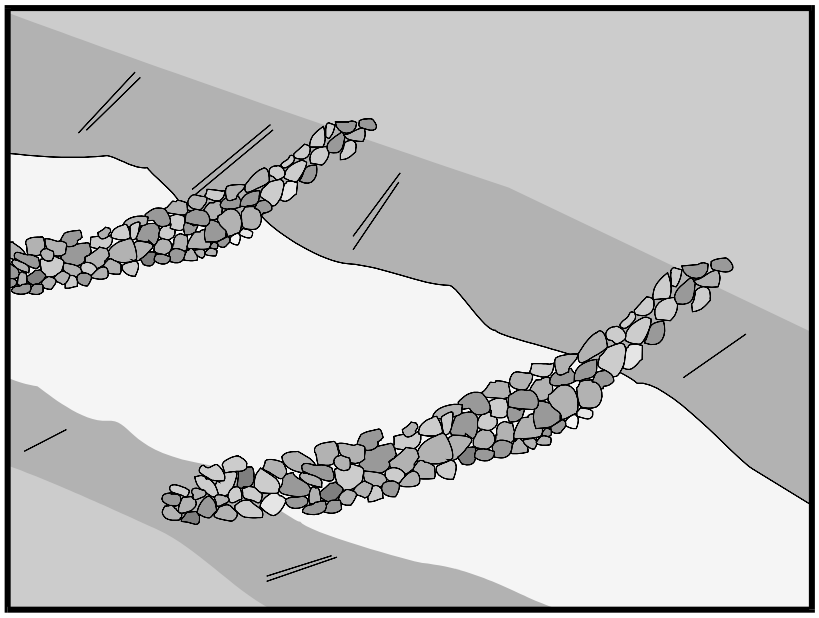




EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE

Check Dams SE-4



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	☒
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	☑
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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Check Dams SE-4

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

Check Dams SE-4

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.

Check Dams SE-4

- 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 or 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.

Check Dams SE-4

- 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.

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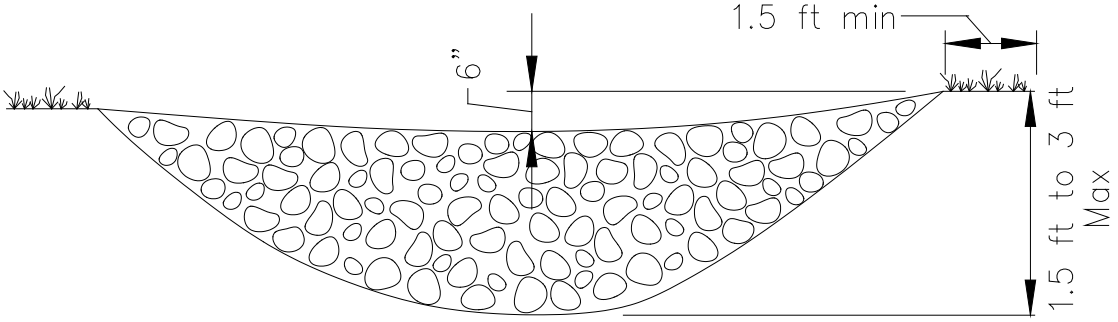
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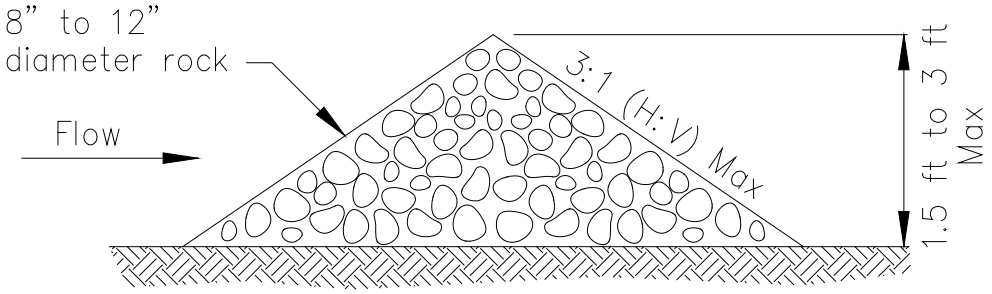
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Check Dams SE-4

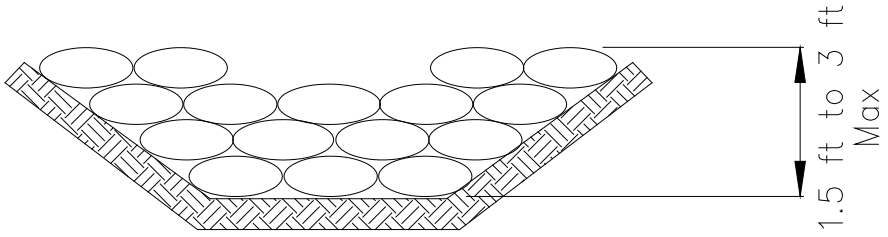


ELEVATION



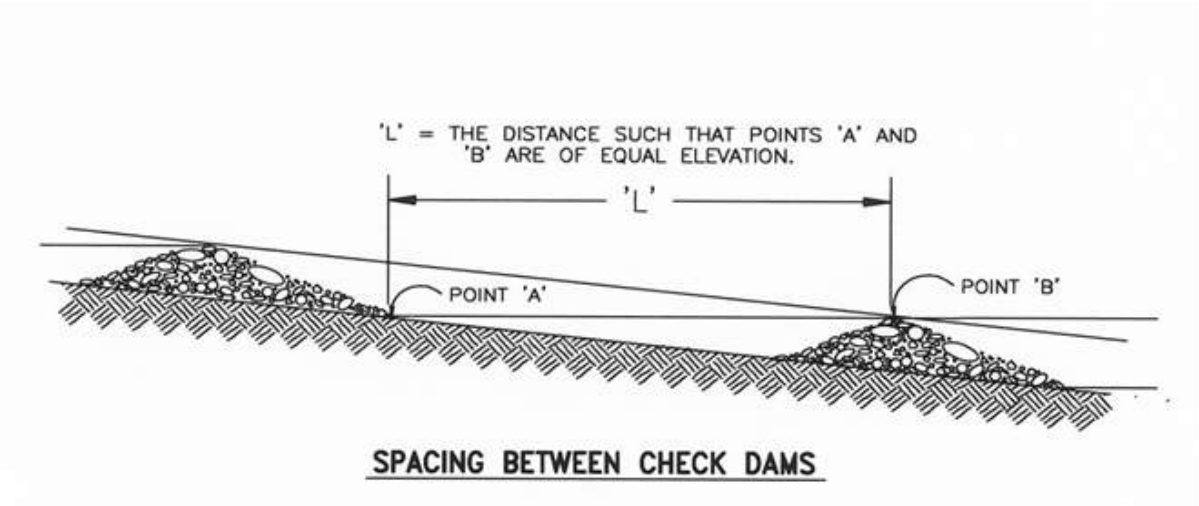
TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE



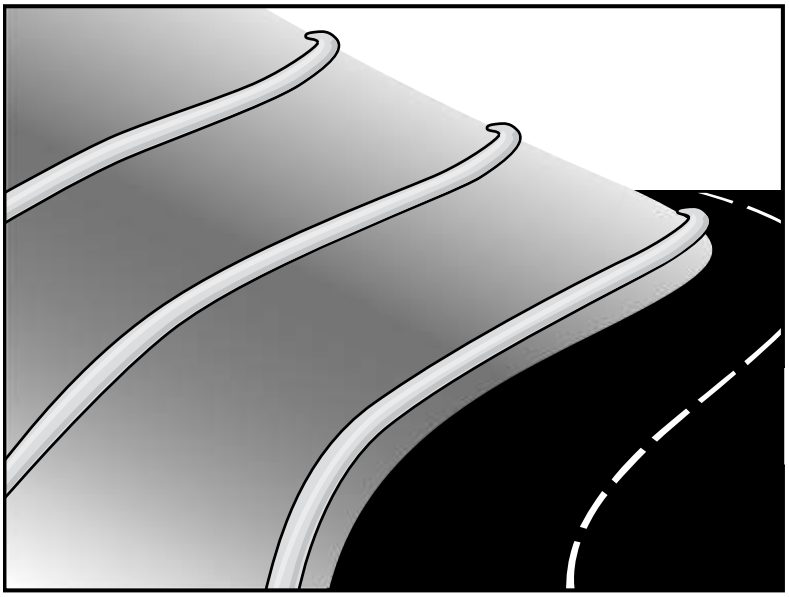
GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE

Check Dams SE-4



SPACING BETWEEN CHECK DAMS

Fiber Rolls SE-5



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

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.

Targeted Constituents

Sediment	☑
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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Fiber Rolls SE-5

- 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.

Fiber Rolls SE-5

  - 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 ¼ to 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.

Fiber Rolls SE-5

Costs

Material costs for straw fiber rolls range from $26 - $38 per 25-ft. roll[1] and curled wood fiber rolls range from $30 - $40 per roll[2].

Material costs for PAM impregnated fiber rolls range between $9.00-$12.00 per linear foot, based upon vendor research[1] .

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.

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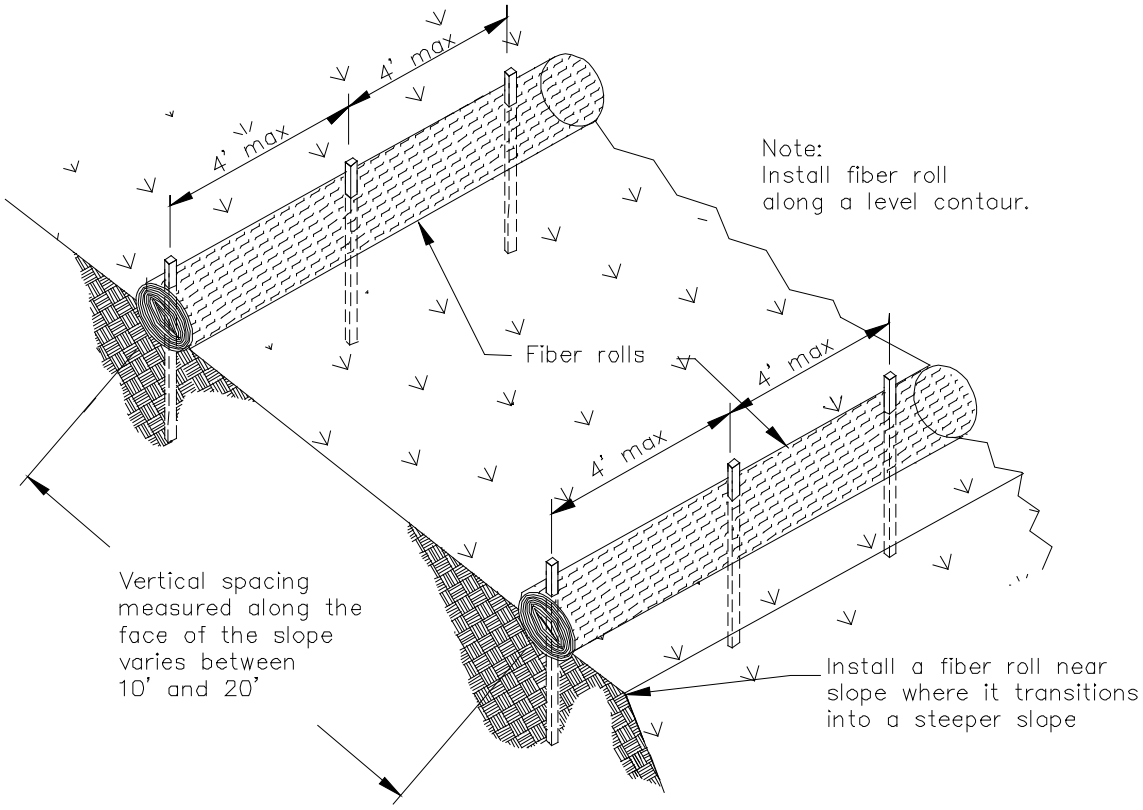
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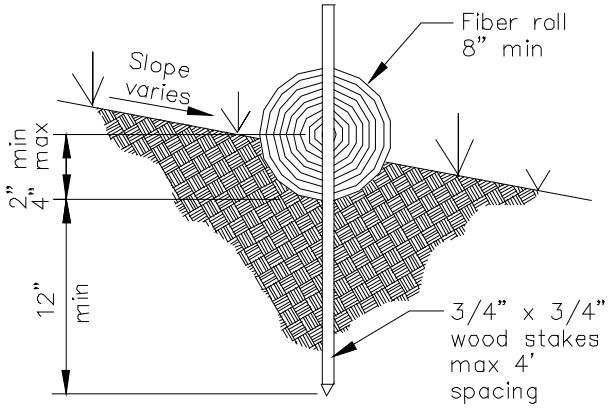
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[1] Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.
[2] Costs estimated based on vendor query by Tetra Tech, Inc. 2016.

Fiber Rolls SE-5

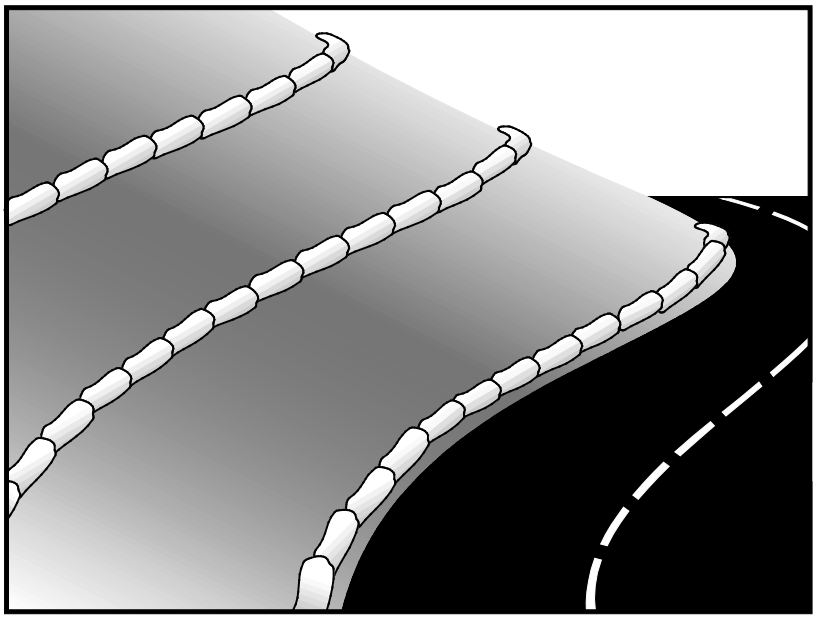


TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Gravel Bag Berm SE-6



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	☒
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	☑
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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Gravel Bag Berm SE-6

- 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.

Gravel Bag Berm SE-6

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^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.

Gravel Bag Berm SE-6

- ***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

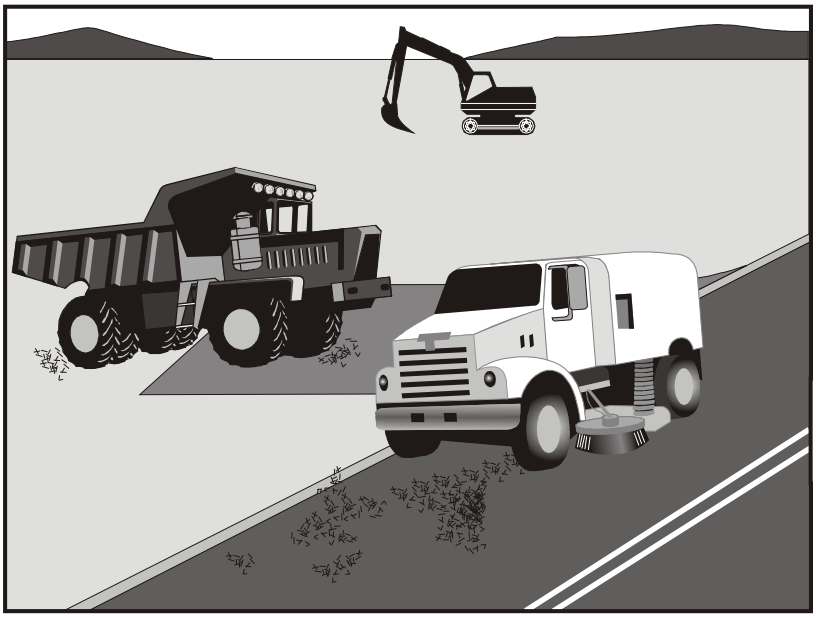
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Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Street Sweeping and Vacuuming SE-7



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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.

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Street Sweeping and Vacuuming SE-7

- 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[1], 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

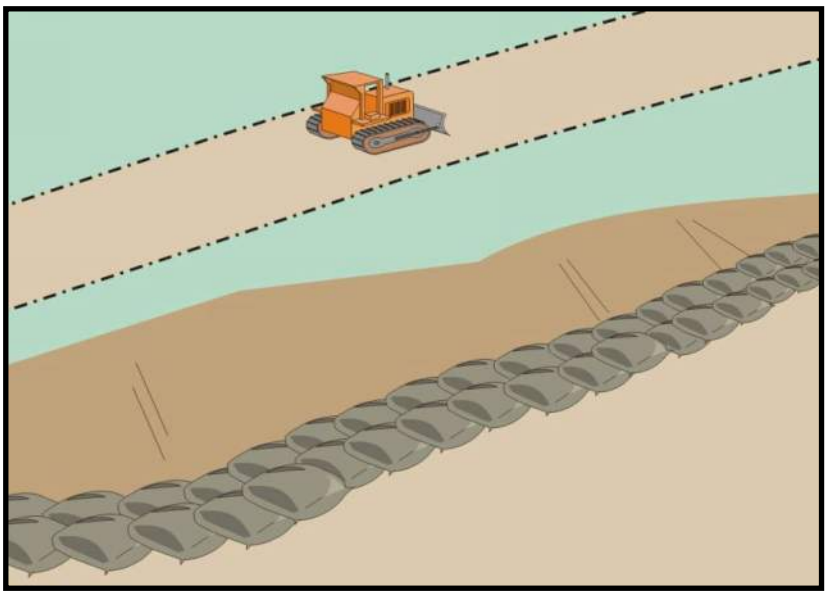
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in 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.

[1] Based on contractor query conducted by Tetra Tech, Inc. November 2016.

Sandbag Barrier SE-8



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

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	☑
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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Sandbag Barrier SE-8

- 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.

Sandbag Barrier SE-8

  - 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^2, Mullen burst strength exceeding 300 lb/in^2 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.

Sandbag Barrier SE-8

- ***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^3. 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.

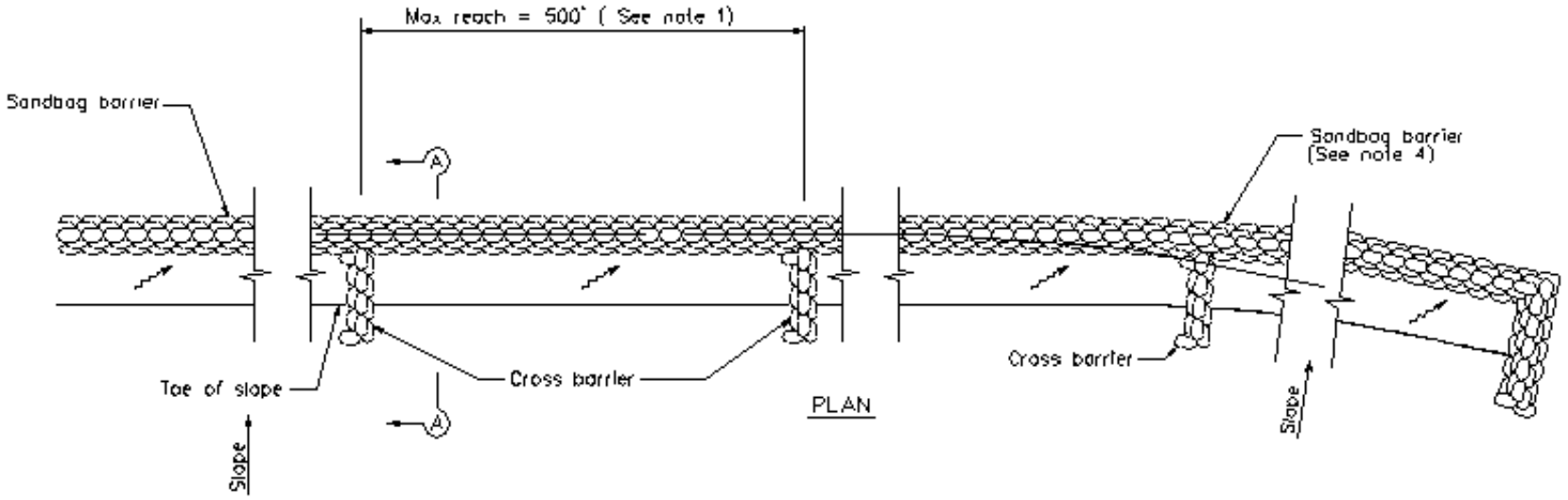
References

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.

Sandbag Barrier SE-8

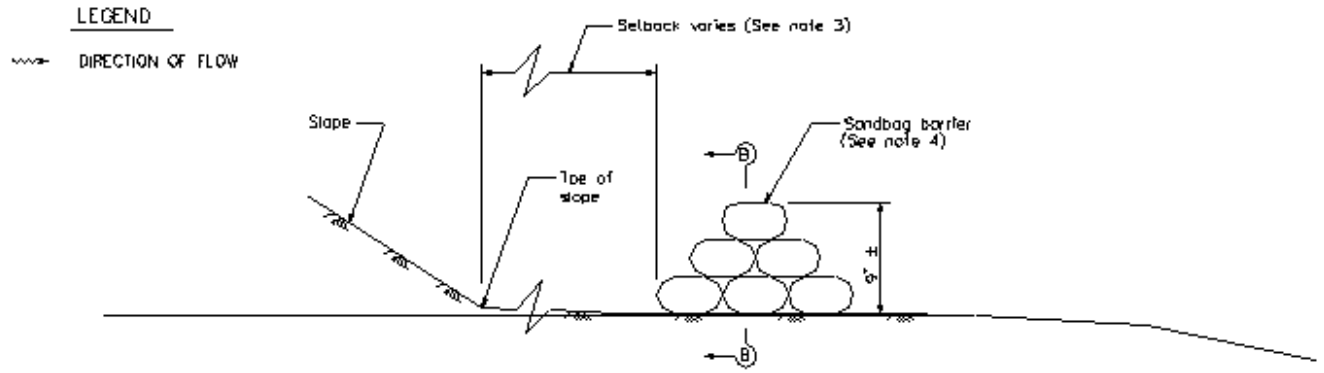


SANDBAG BARRIER

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.

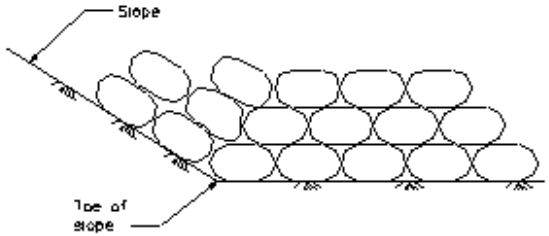
Sandbag Barrier SE-8



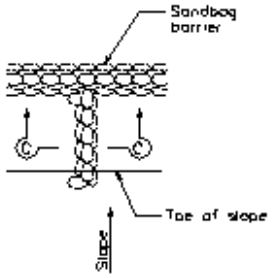
SECTION A–A



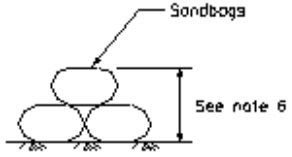
SECTION B–B



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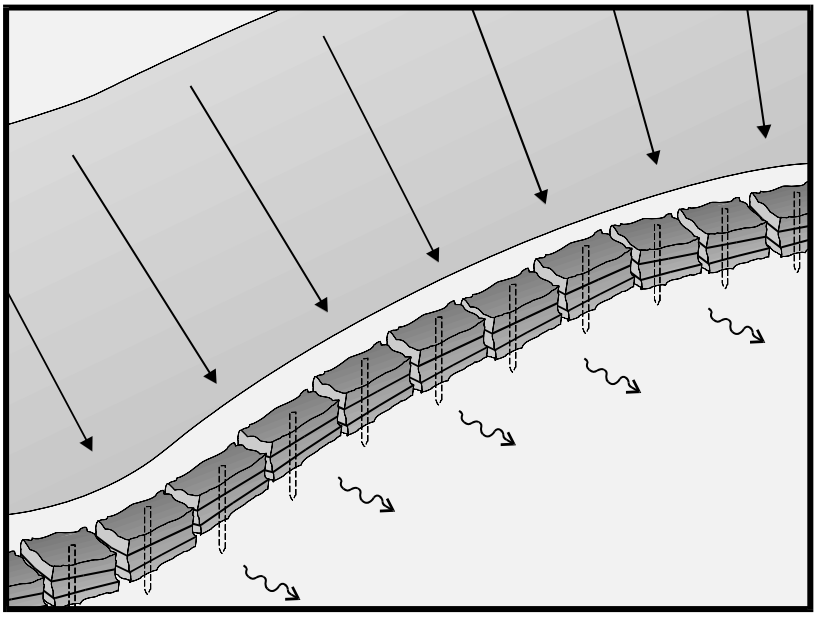


CROSS BARRIER DETAIL



SECTION C–C

Straw Bale Barrier SE-9



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
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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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

Straw Bale Barrier SE-9

- 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.

Straw Bale Barrier SE-9

- 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.

Straw Bale Barrier SE-9

Inspection and Maintenance

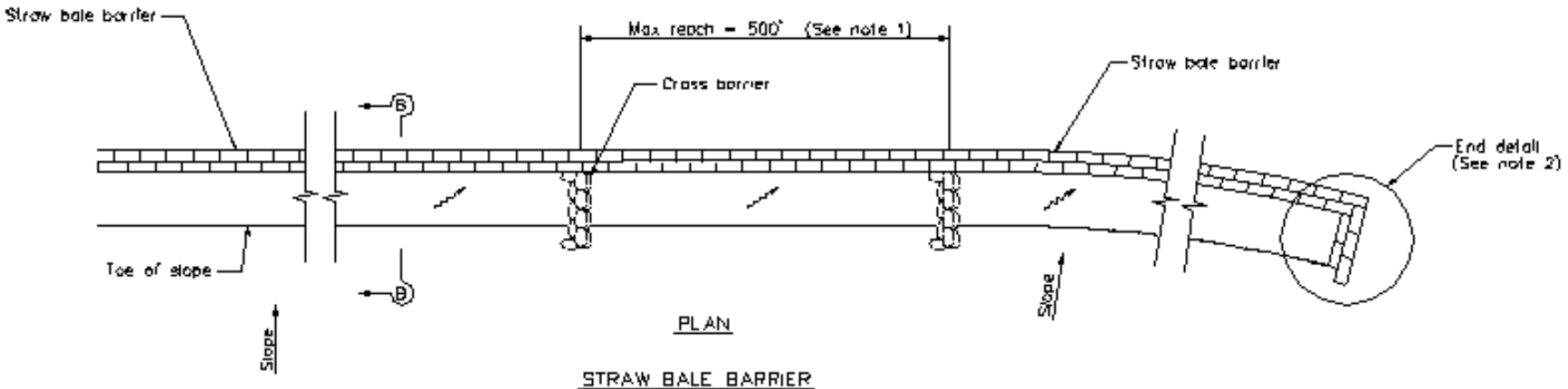
Maintenance

- 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.

Straw Bale Barrier SE-9



STRAW BALE BARRIER

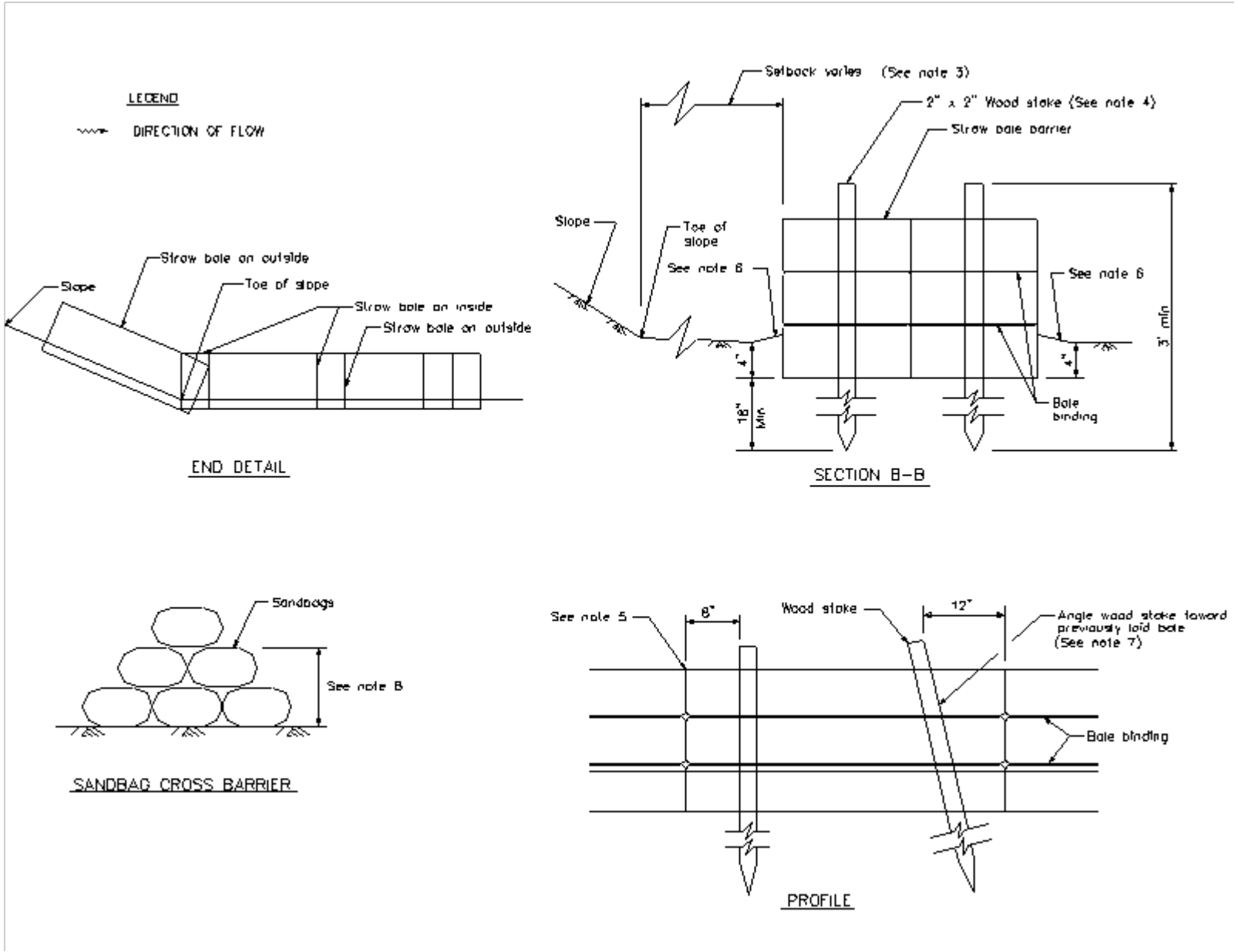
NOTES

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. The end of barrier shall be turned up slope.
3. Dimension may vary to fit field condition.
4. Stake dimensions are nominal.
5. Place straw bales tightly together.
6. Tamp embedment spoils against sides of installed bales
7. Drive angled wood stake before vertical stake to ensure tight abutment to adjacent bale.
8. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.

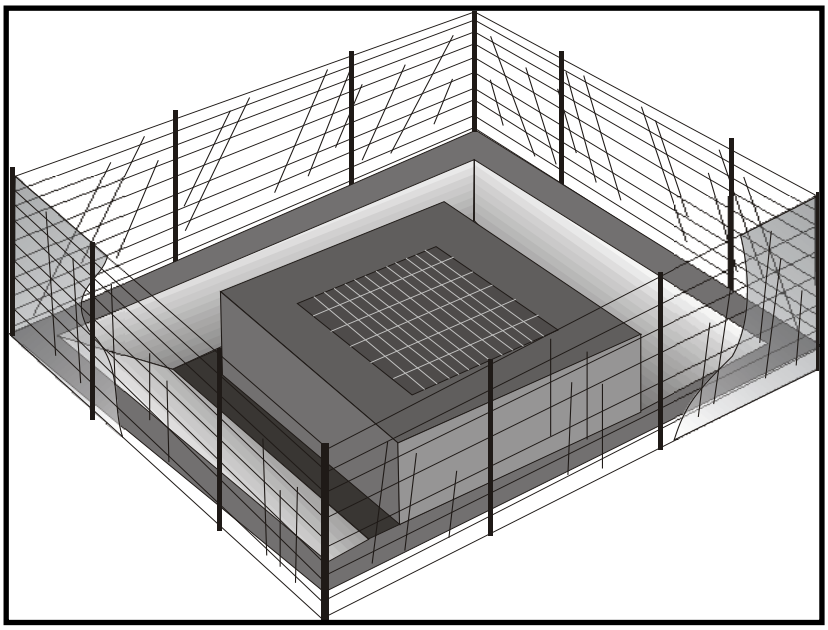
LEGEND

DIRECTION OF FLOW

Straw Bale Barrier SE-9



Storm Drain Inlet Protection SE-10



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
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-14 Biofilter Bags
SE-13 Compost Socks and Berms

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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

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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.

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- 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.

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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^3/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.

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- ***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.

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- 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.

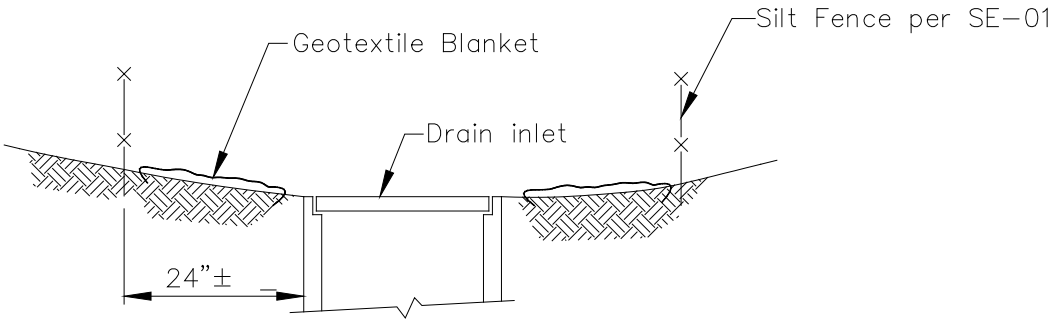
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

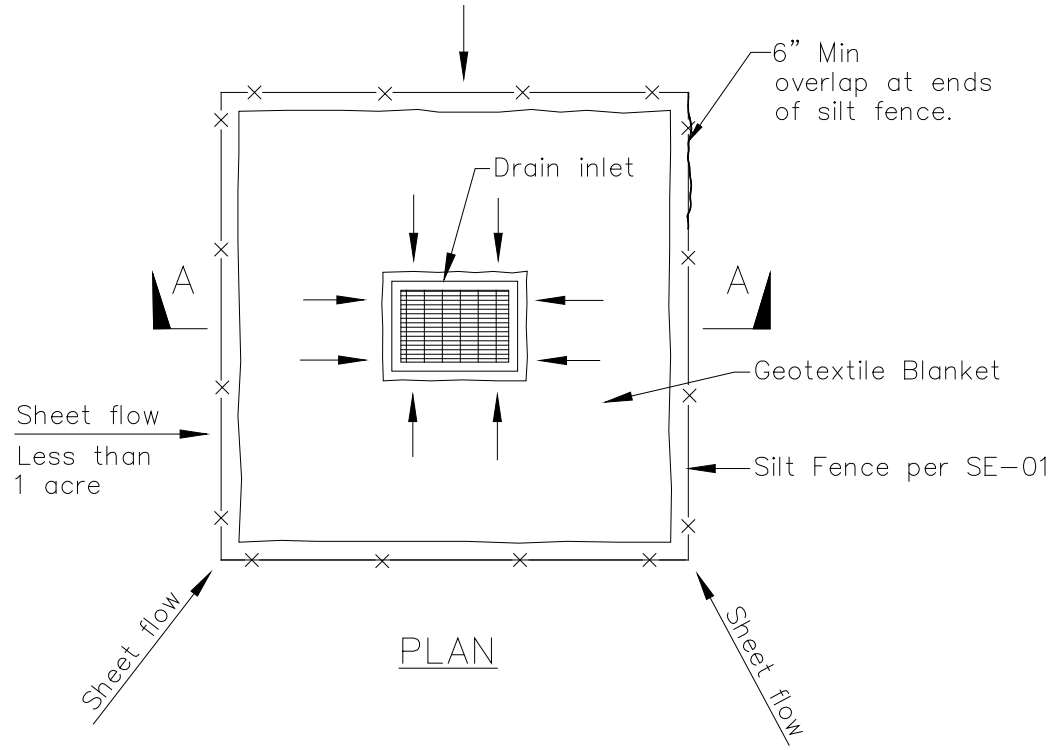
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Storm Drain Inlet Protection SE-10



SECTION A–A



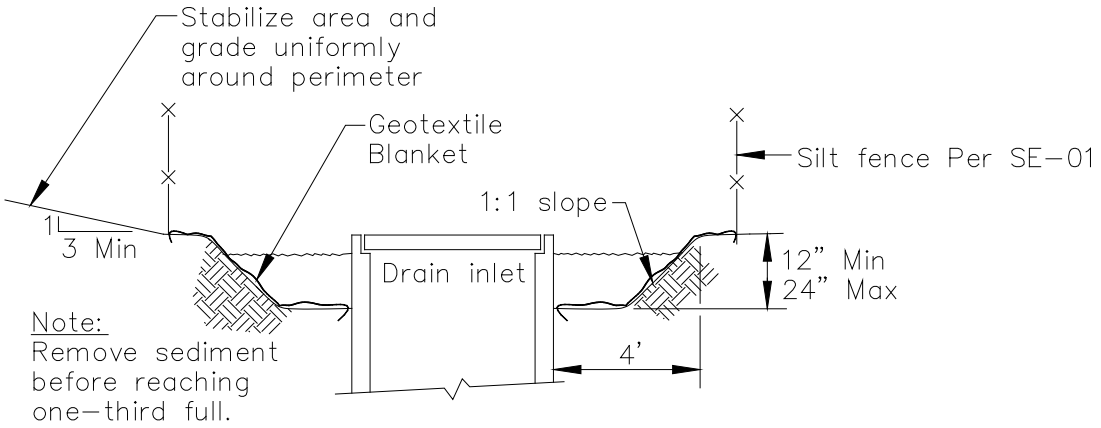
PLAN

DI PROTECTION TYPE 1
NOT TO SCALE

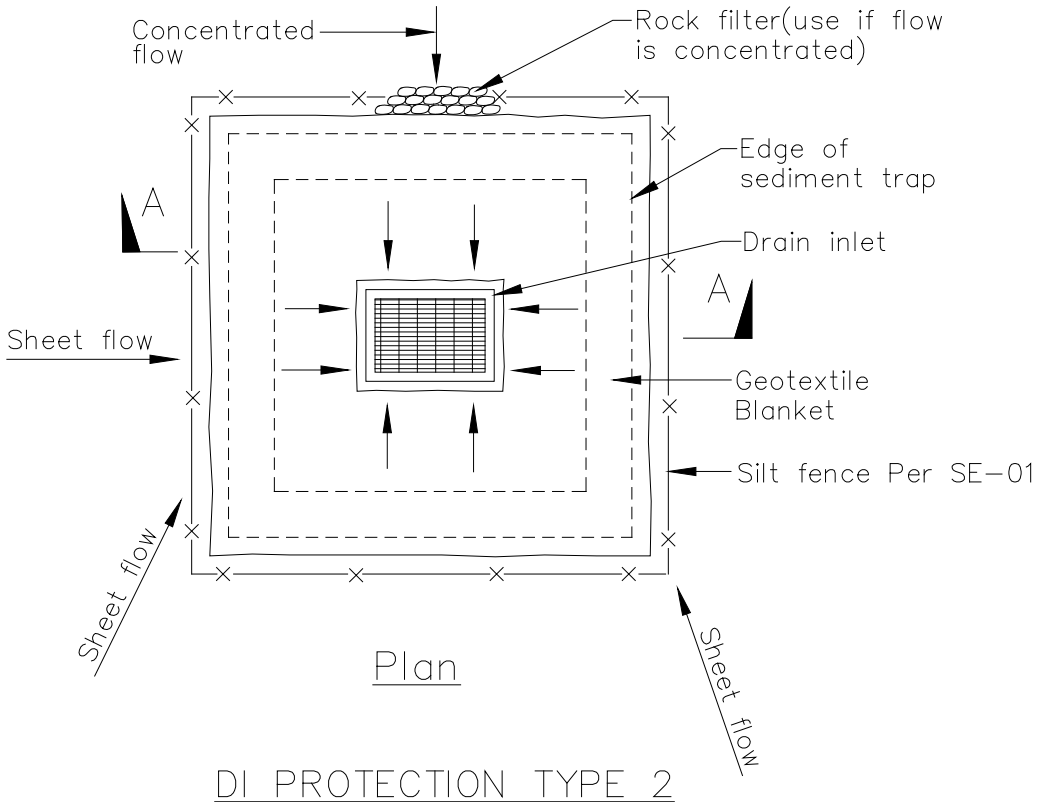
NOTES:

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.

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Section A–A

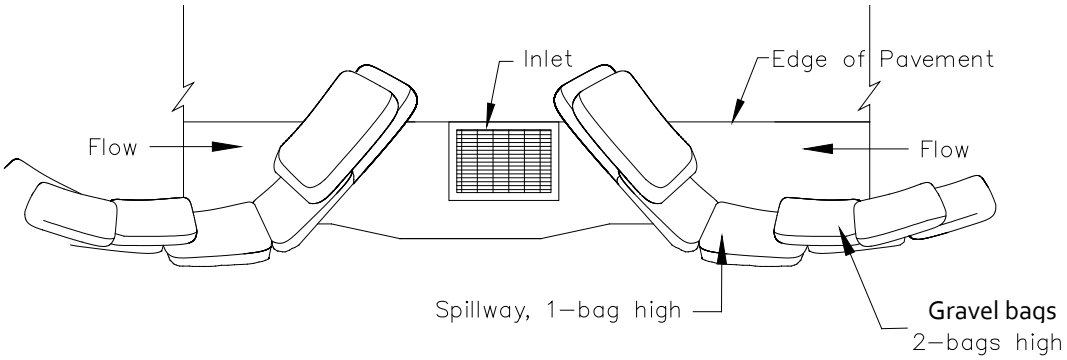


Plan

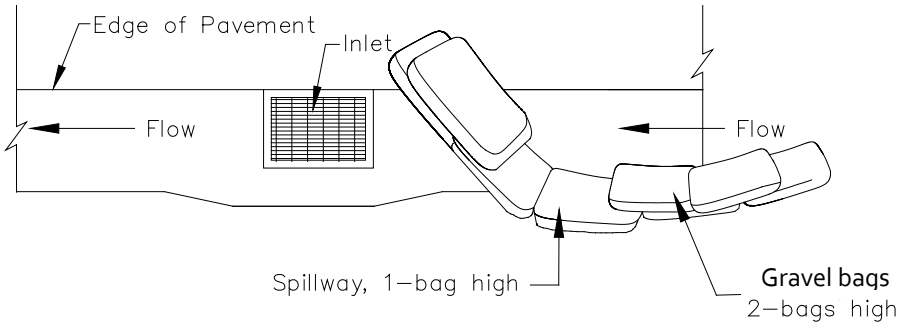
DI PROTECTION TYPE 2
NOT TO SCALE

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.

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TYPICAL PROTECTION FOR INLET ON SUMP



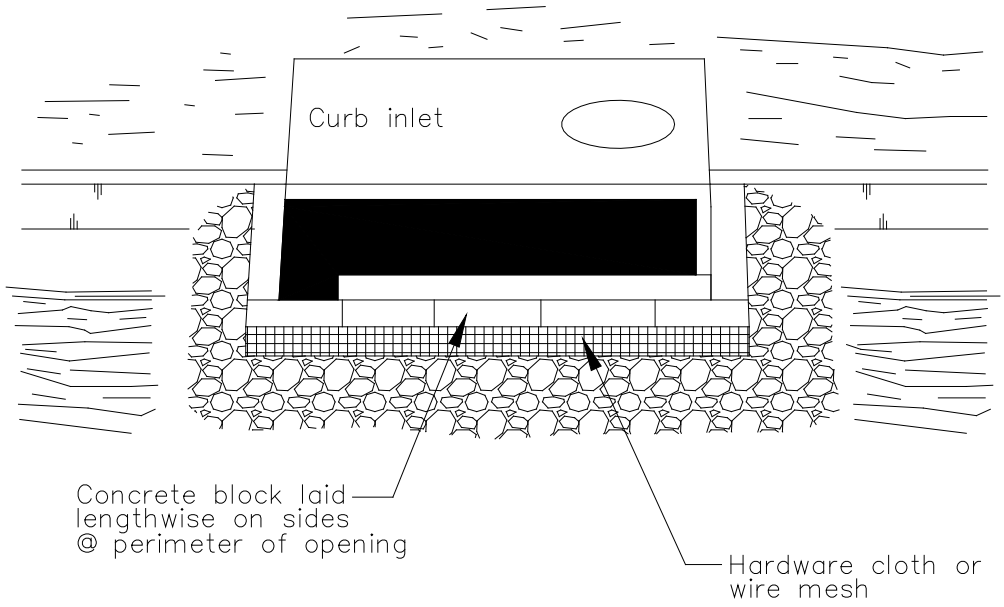
TYPICAL PROTECTION FOR INLET ON GRADE

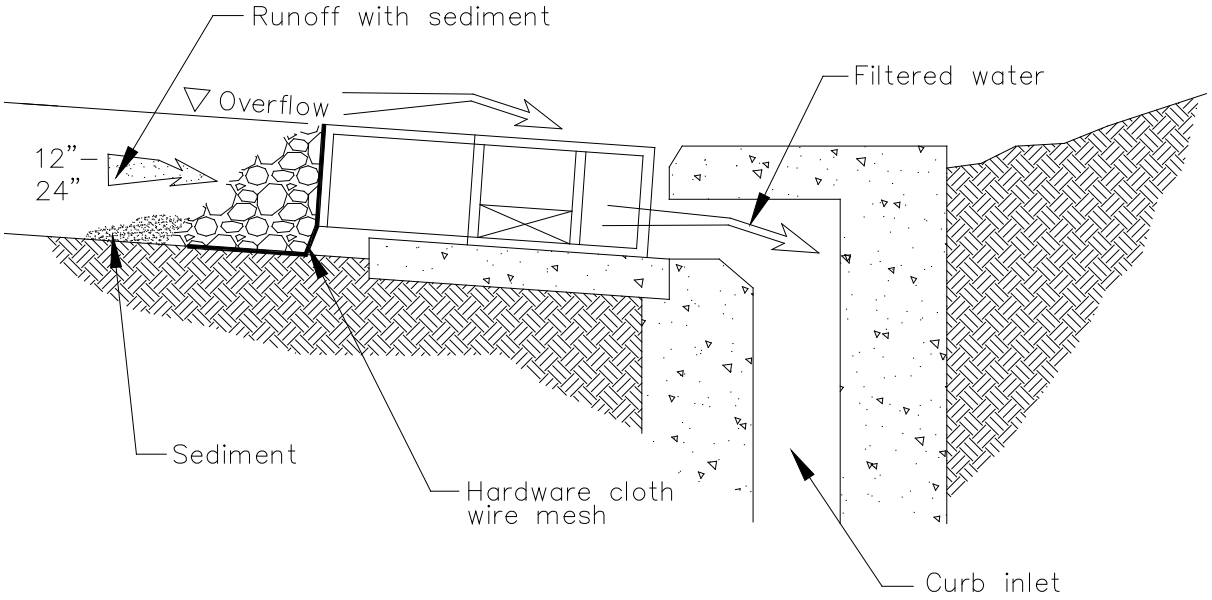
NOTES:

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

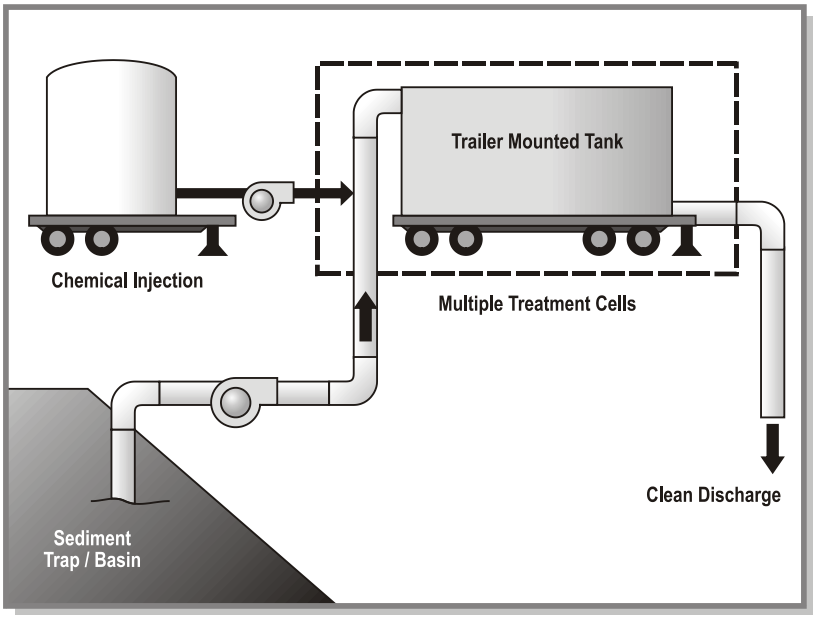
Storm Drain Inlet Protection SE-10





DI PROTECTION – TYPE 4
NOT TO SCALE

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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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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:

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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).

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- 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.

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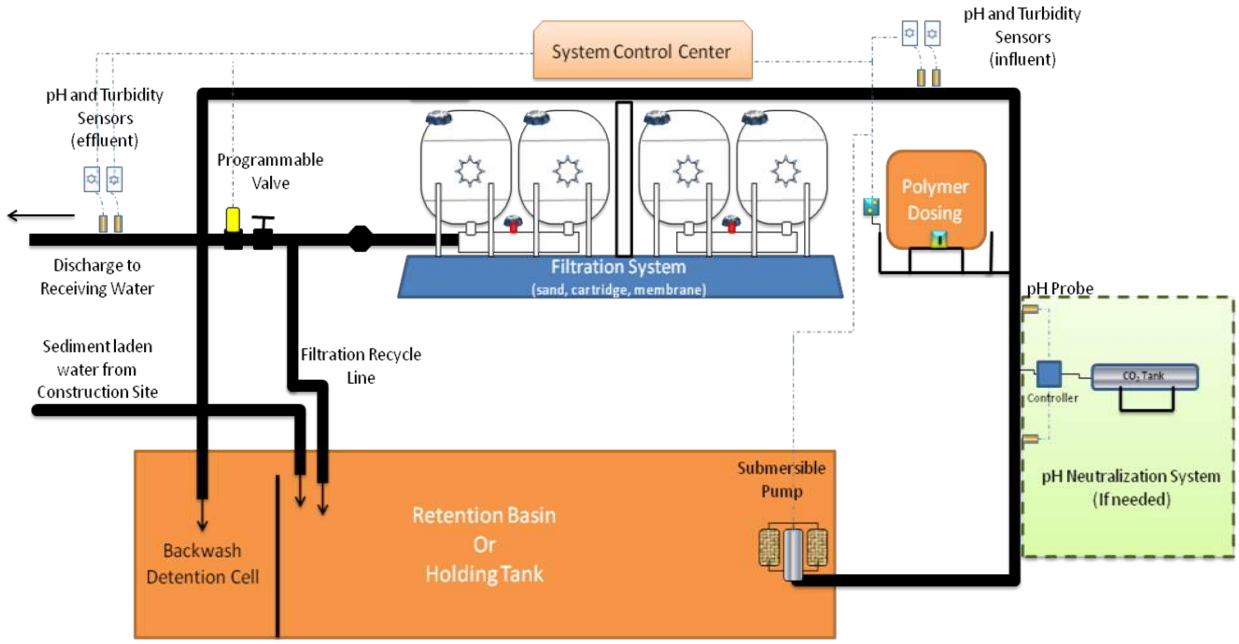


Figure has been adapted from Port of Seattle response to Washington Dept. of Ecology Action Order 2948

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.

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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

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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.

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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.

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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

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Manufactured Linear Sediment Controls (MLSC) SE-12






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	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
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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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.

Manufactured Linear Sediment Controls (MLSC) SE-12

- 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

- "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, January26, 2011.

Stormwater Management Manual for Western Washington Volume II, Construction Stormwater Pollution Prevention, Washington State Department of Ecology, February 2005.

Compost Socks and Berms SE-13



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	☒
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	☑
Nutrients	
Trash	
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

SE-14 Biofilter Bags

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Compost Socks and Berms SE-13

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.

Compost Socks and Berms SE-13

- 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

Compost Socks and Berms SE-13

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 contaminates.
- 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.

Compost Socks and Berms SE-13

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 and Berms SE-13

- 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.

Compost Socks and Berms SE-13

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, 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.

Compost Socks and Berms SE-13

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, 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.

Biofilter Bags SE-14



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	☑
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	☑
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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Biofilter Bags SE-14

  - 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.

Biofilter Bags SE-14

- 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.

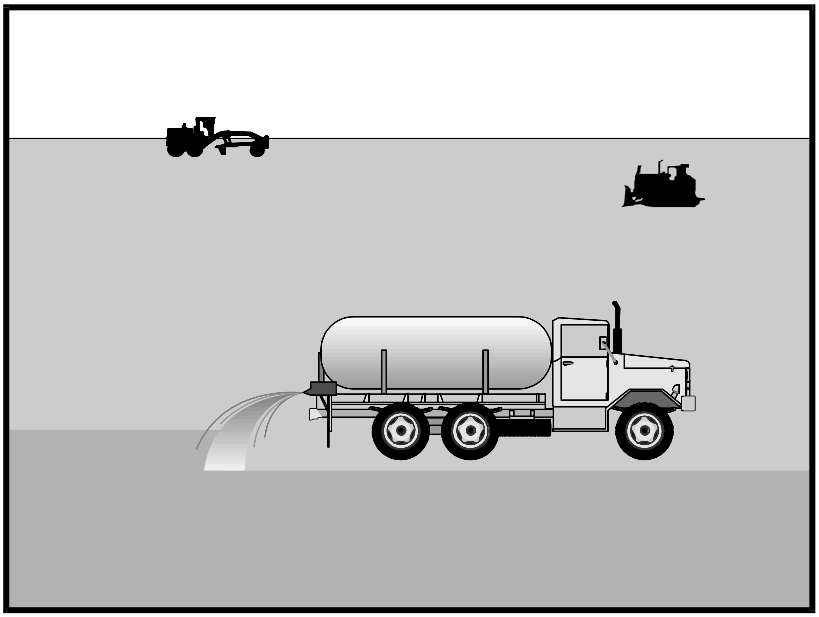
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Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

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Wind Erosion Control WE-1



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

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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:

Wind Erosion Control WE-1

- 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.

Wind Erosion Control WE-1

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

Wind Erosion Control WE-1

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.

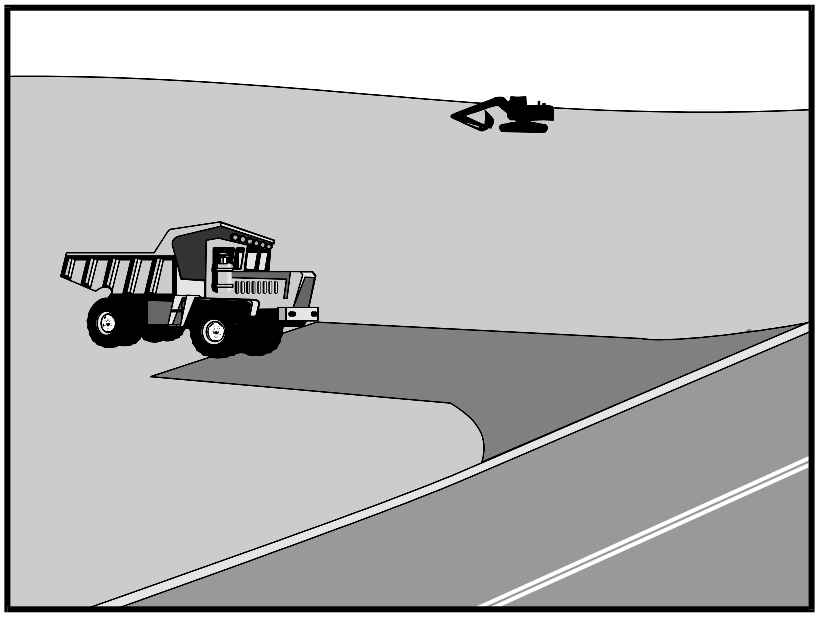
Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

Wind Erosion Control WE-1

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), 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



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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.

Stabilized Construction Entrance/Exit TC-1

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

- 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.

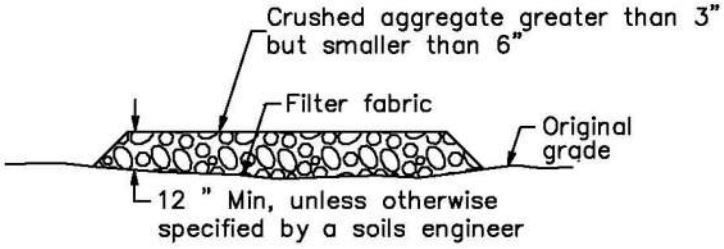
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

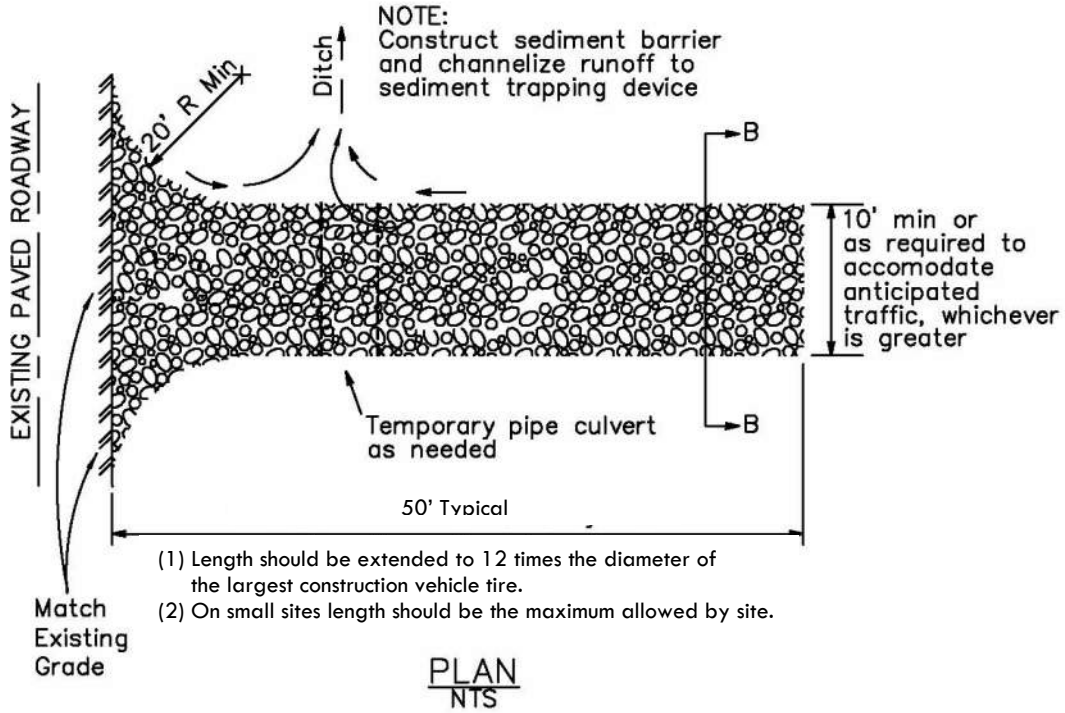
Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

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



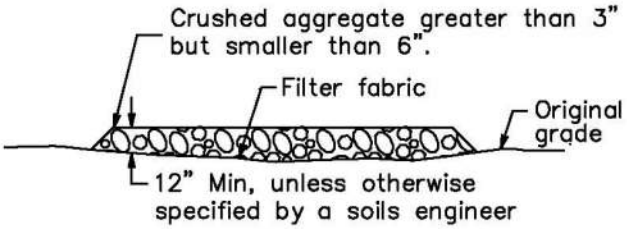
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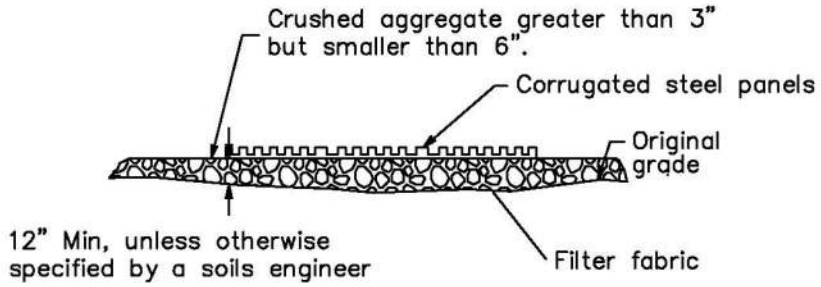
(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS

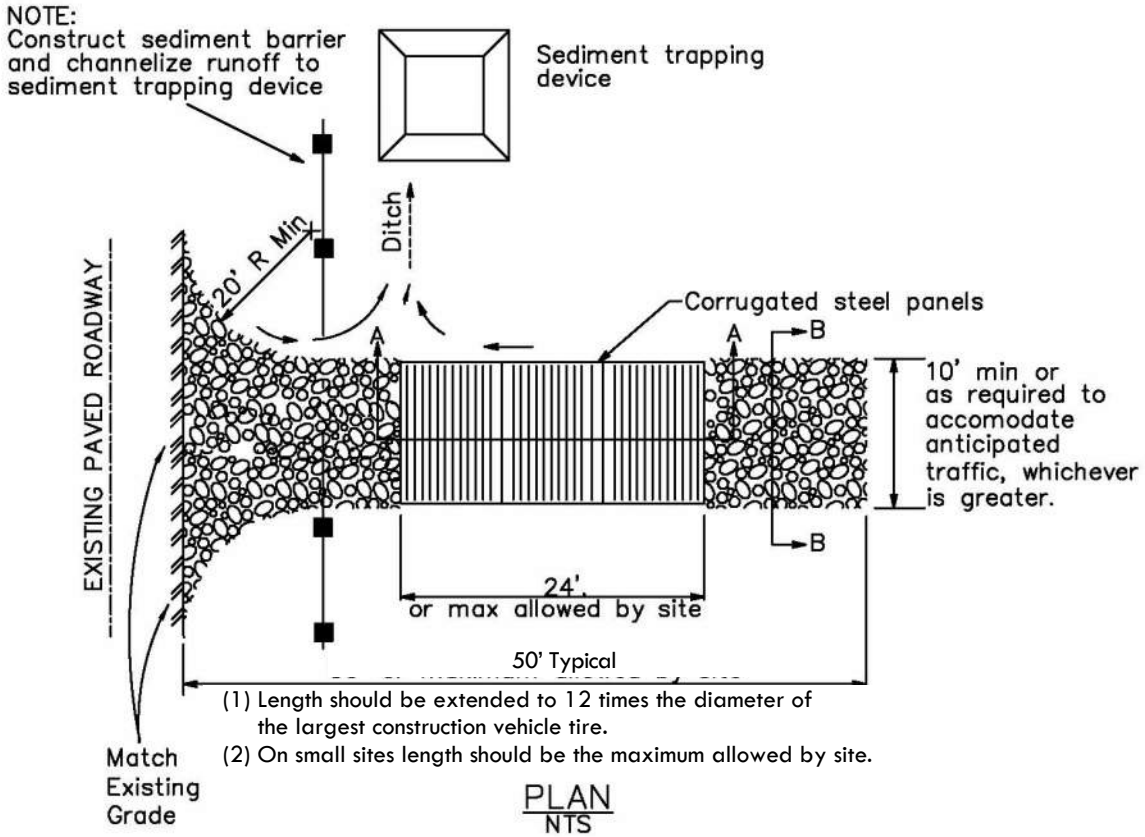
Stabilized Construction Entrance/Exit TC-1



SECTION B–B
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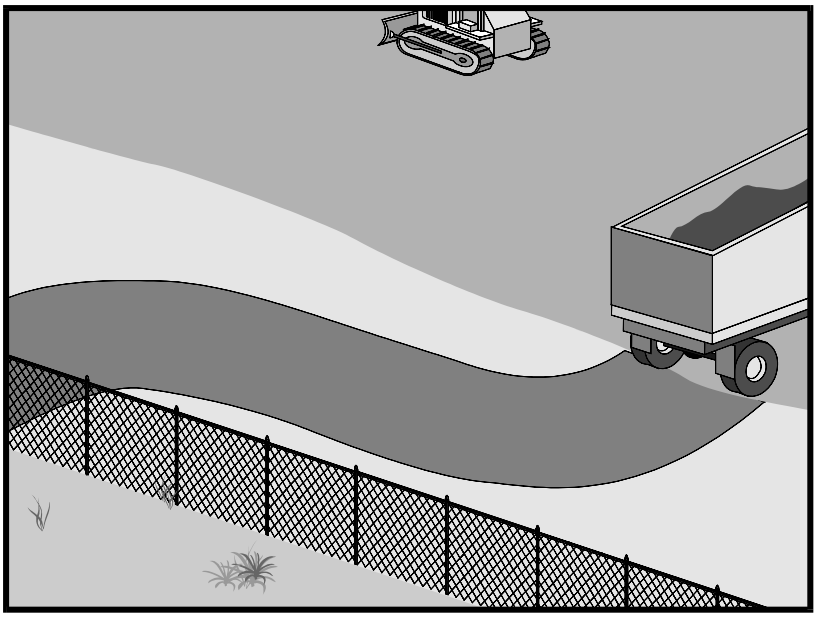
SECTION A–A
NOT TO SCALE



(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS

Stabilized Construction Roadway TC-2



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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.

Stabilized Construction Roadway TC-2

- 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.

Stabilized Construction Roadway TC-2

- 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.

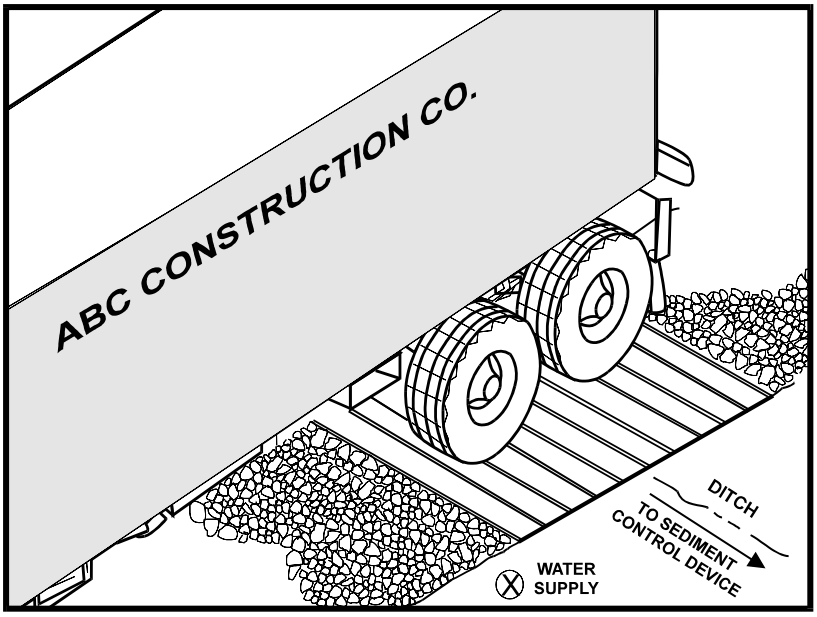
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Stabilized Construction Roadway TC-2

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.

Entrance/Outlet Tire Wash TC-3



Description and Purpose

A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages 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.

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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

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Entrance/Outlet Tire Wash TC-3

- 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.

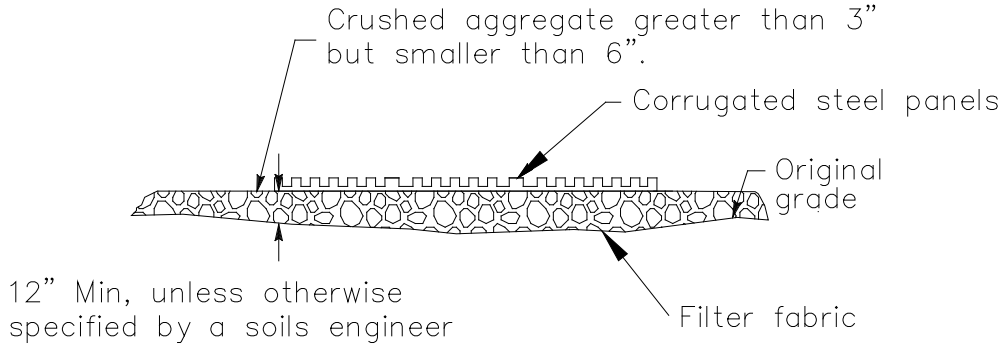
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Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

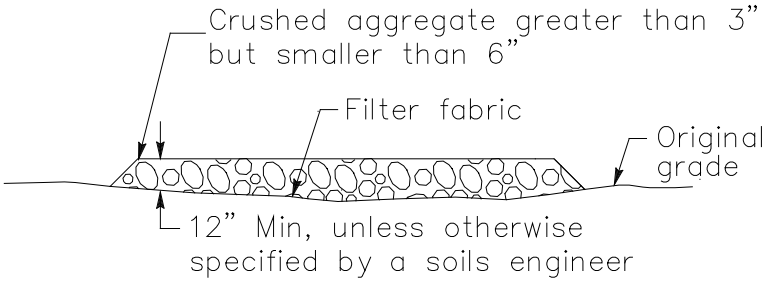
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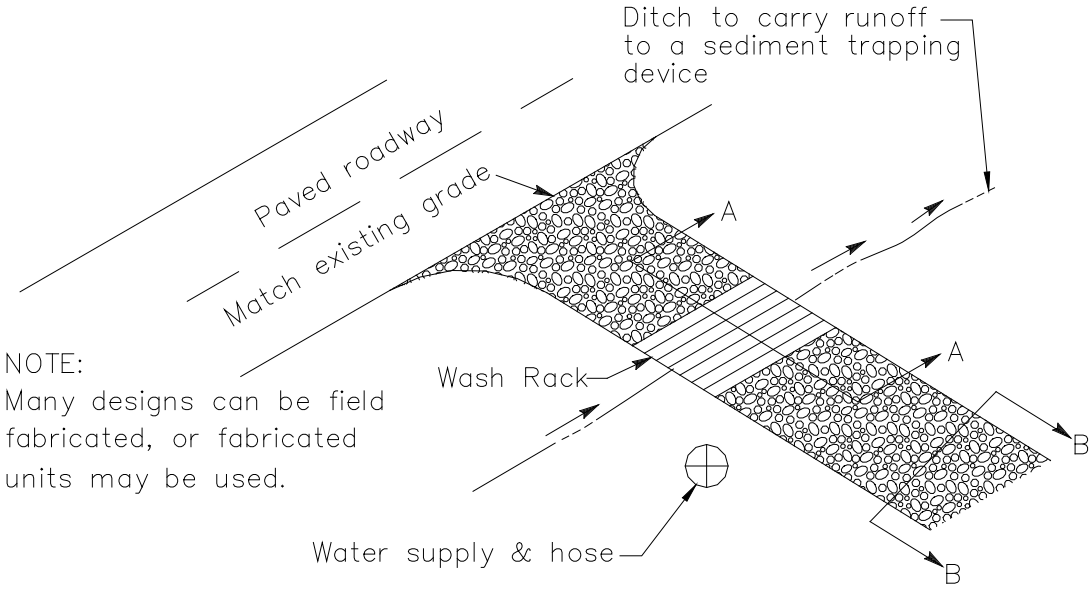
Entrance/Outlet Tire Wash TC-3



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[2]
NS-2	Dewatering Operations[1, 3]
NS-3	Paving and Grinding Operations[1, 3]
NS-4	Temporary Stream Crossing[1, 2]
NS-5	Clear Water Diversion[2]
NS-6	Illicit Connection/Discharge[1, 2]
NS-7	Potable Water/Irrigation[1, 2]
NS-8	Vehicle and Equipment Cleaning[1, 2]
NS-9	Vehicle and Equipment Fueling[1, 2]
NS-10	Vehicle and Equipment Maintenance[1, 2]
NS-11	Pile Driving Operations[1, 2]
NS-12	Concrete Curing[1, 3]
NS-13	Concrete Finishing[1, 3]
NS-14	Material Over Water[1, 2]
NS-15	Demolition Adjacent to Water[1, 2]
NS-16	Temporary Batch Plants[1, 3]

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.

Table 4-2 Waste Management and Materials Pollution Control BMPs

BMP#	BMP Name
WM-1	Material Delivery and Storage[1]
WM-2	Material Use[1]
WM-3	Stockpile Management[1, 2, 3]
WM-4	Spill Prevention and Control[1, 2]
WM-5	Solid Waste Management[1, 2]
WM-6	Hazardous Waste Management[1, 2]
WM-7	Contaminated Soil Management[1, 2]
WM-8	Concrete Waste Management[1, 3]
WM-9	Sanitary/ Septic Waste Management[1]
WM-10	Liquid Waste Management[1]

1) BMP fact sheet updated in 2009
2) BMP fact sheet updated in 2011
3) BMP fact sheet updated in 2012

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

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

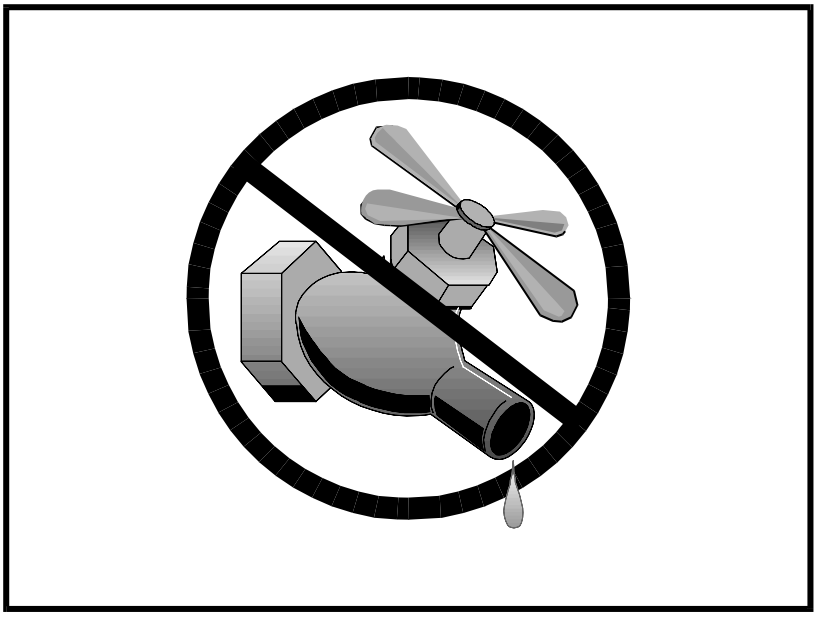
Figure 4-1
Example Fact Sheet

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.

Water Conservation Practices NS-1



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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.

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Water Conservation Practices NS-1

- 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.

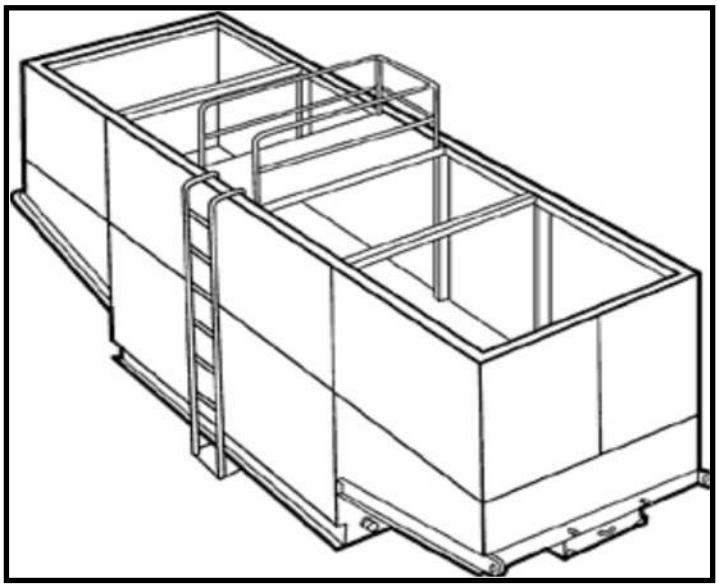
Inspection and Maintenance

- 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 occuring.
- 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.

Dewatering Operations NS-2



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

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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

Dewatering Operations NS-2

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.

Dewatering Operations NS-2

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:

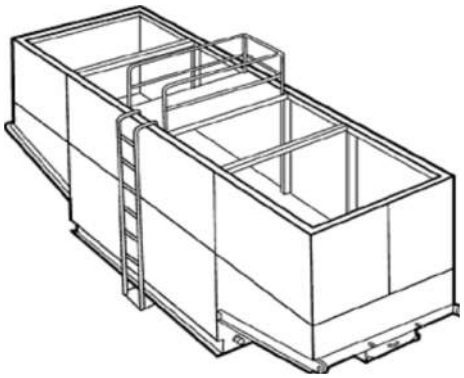
- Excavation and construction of related facilities is required.
- Trap inlets should be located to maximize the travel distance to the trap outlet.
- Use rock or vegetation to protect the trap outlets against erosion.

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.

Dewatering Operations NS-2

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 Operations NS-2

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.

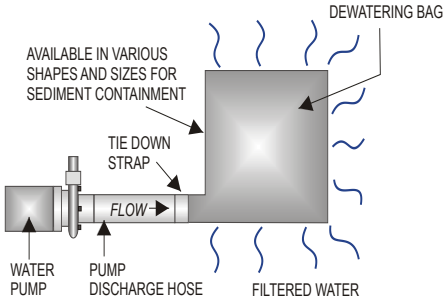
Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal should be conducted by licensed waste disposal company.

Dewatering Operations NS-2

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.

Dewatering Operations NS-2

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.

Dewatering Operations NS-2

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.

Dewatering Operations NS-2

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.

Dewatering Operations NS-2

- 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.

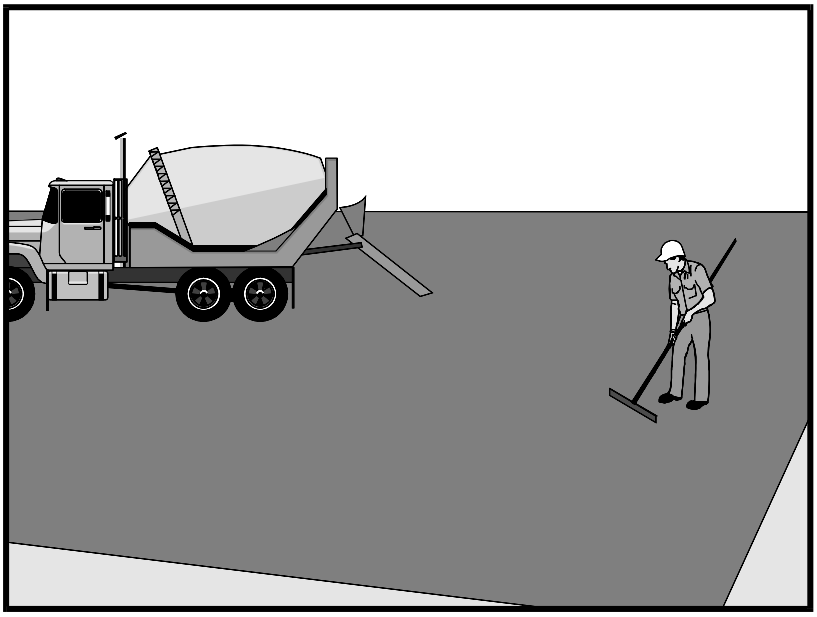
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Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

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.

Paving and Grinding Operations NS-3



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	☒

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon 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.

Paving and Grinding Operations NS-3

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 runon (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.

Paving and Grinding Operations NS-3

- 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.

Paving and Grinding Operations NS-3

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.

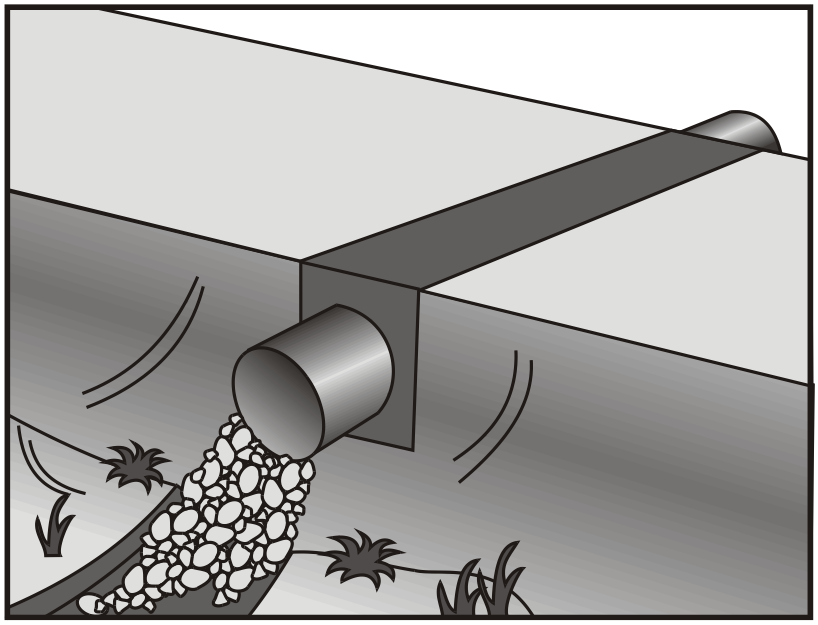
Paving and Grinding Operations NS-3

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.

Temporary Stream Crossing NS-4



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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 streams 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

Temporary Stream Crossing NS-4

- 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.

Temporary Stream Crossing NS-4

- 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.

Temporary Stream Crossing NS-4

- 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.

Temporary Stream Crossing NS-4

- 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^2 (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.

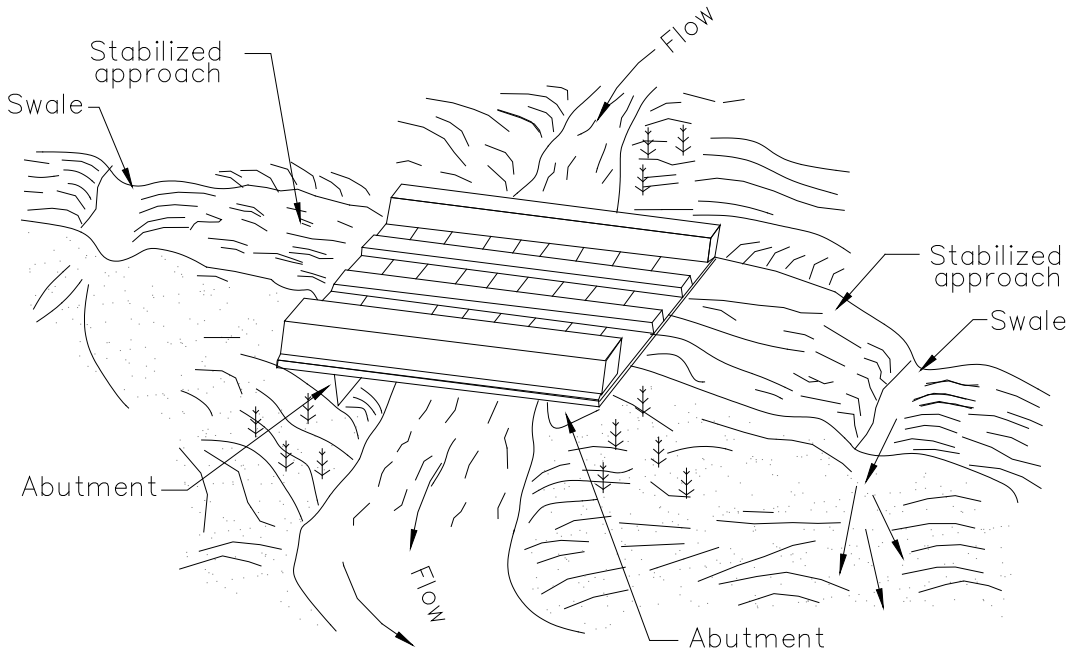
- Remove temporary crossing promptly when it is no longer needed.

References

California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

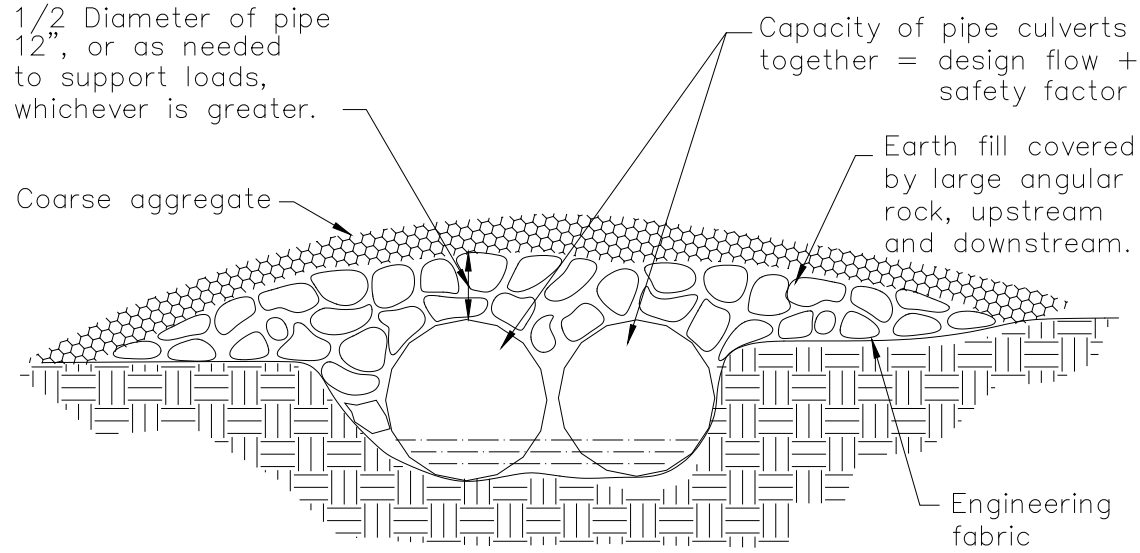
Temporary Stream Crossing NS-4



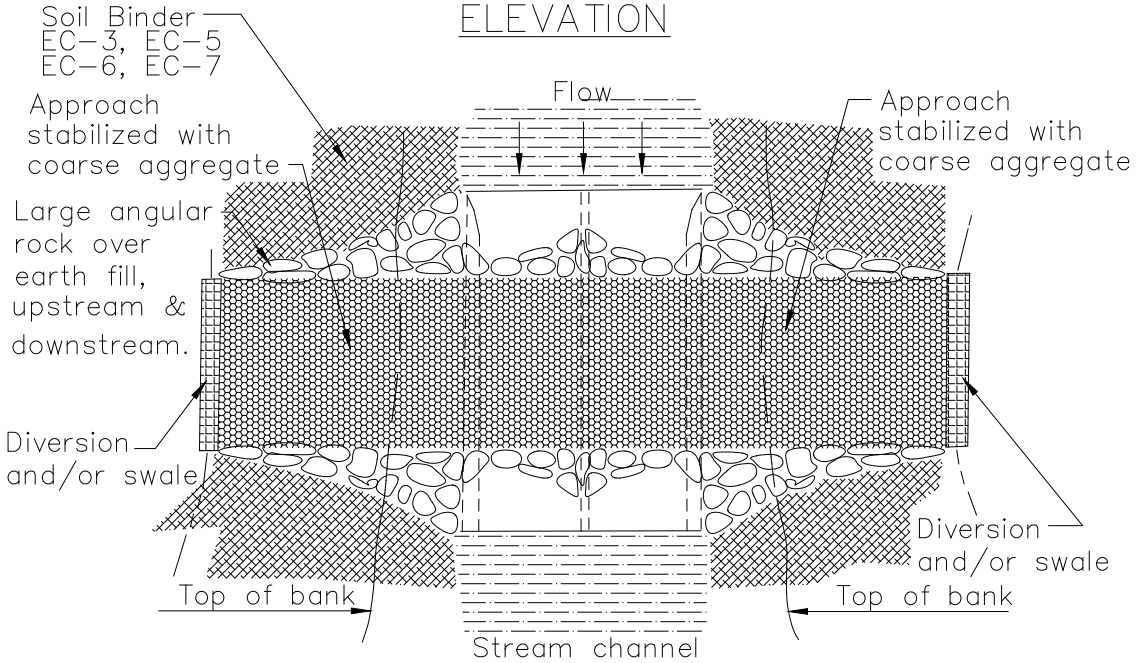
NOTE:
Surface flow of road diverted by swale and/or dike.

TYPICAL BRIDGE CROSSING
NOT TO SCALE

Temporary Stream Crossing NS-4



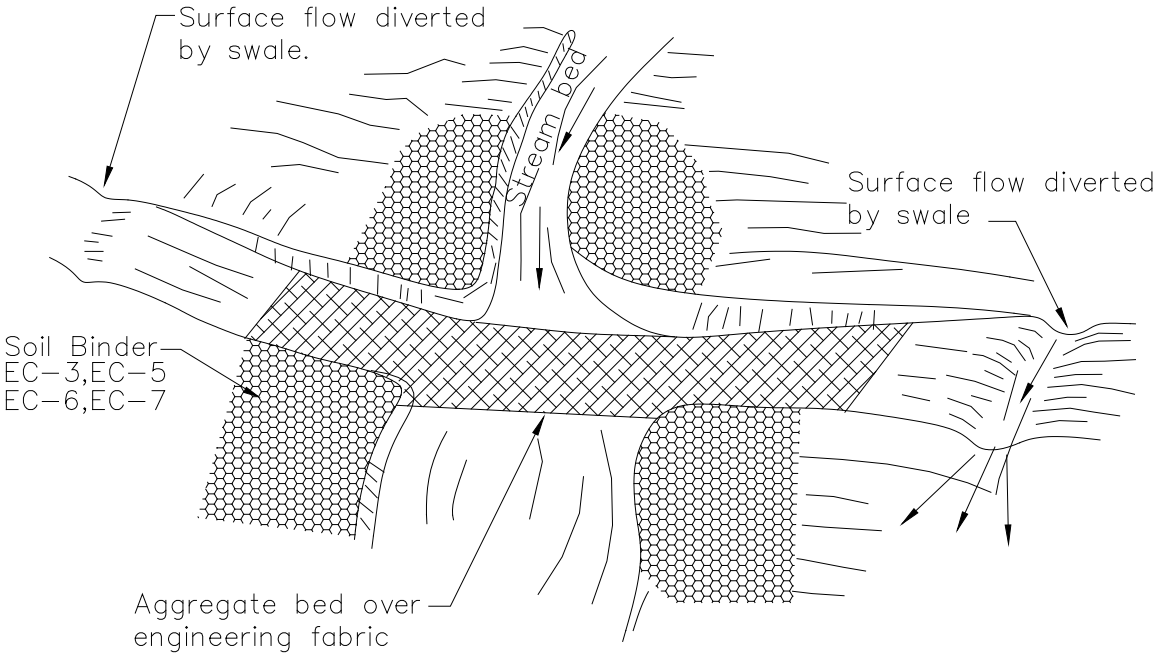
ELEVATION



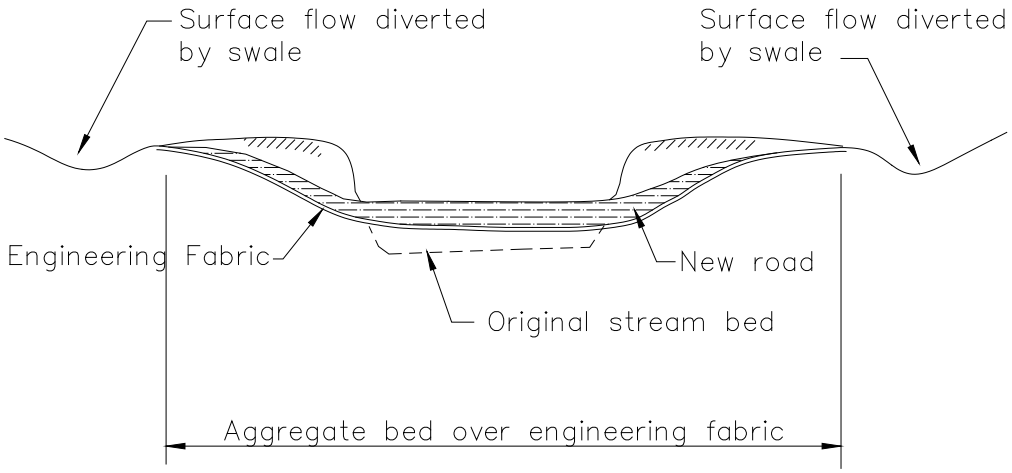
PLAN VIEW

TYPICAL CULVERT CROSSING
NOT TO SCALE

Temporary Stream Crossing NS-4

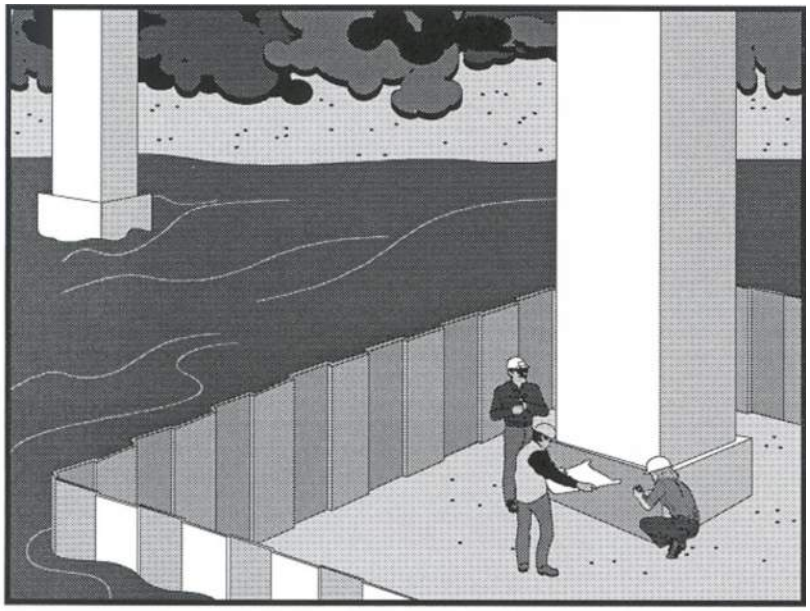


Aggregate approch
1:5 (V:H) Maximum slope on road



TYPICAL FORD CROSSING
NOT TO SCALE

Clear Water Diversion NS-5



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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

Clear Water Diversion NS-5

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.

Clear Water Diversion NS-5

- 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.

Clear Water Diversion NS-5

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.

Clear Water Diversion NS-5

- 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).

Clear Water Diversion NS-5

- 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.

Clear Water Diversion NS-5

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.

Clear Water Diversion NS-5

- 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.

Clear Water Diversion NS-5

Inspection and Maintenance

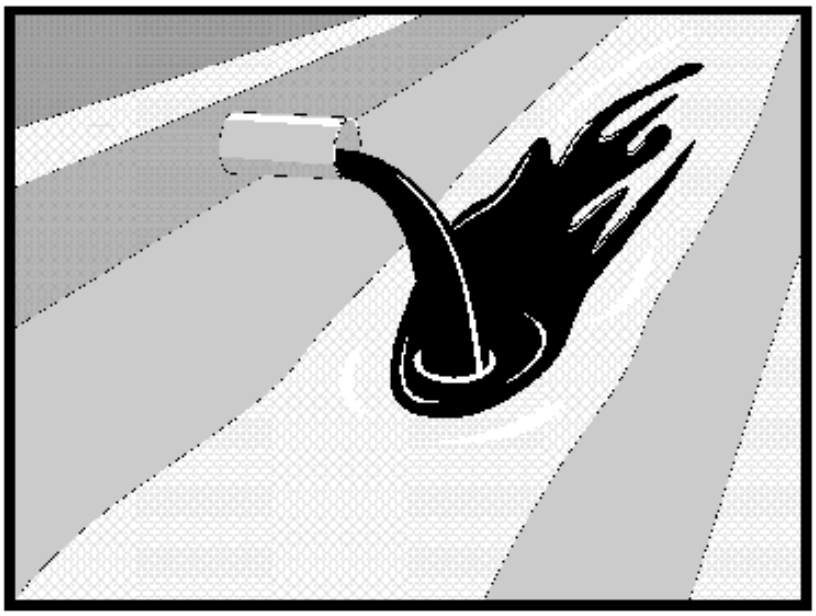
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at 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.

Illicit Connection/Discharge NS-6



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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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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CALIFORNIA STORMWATER QUALITY ASSOCIATION

Illicit Connection/Discharge NS-6

- 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.

Illicit Connection/Discharge NS-6

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.

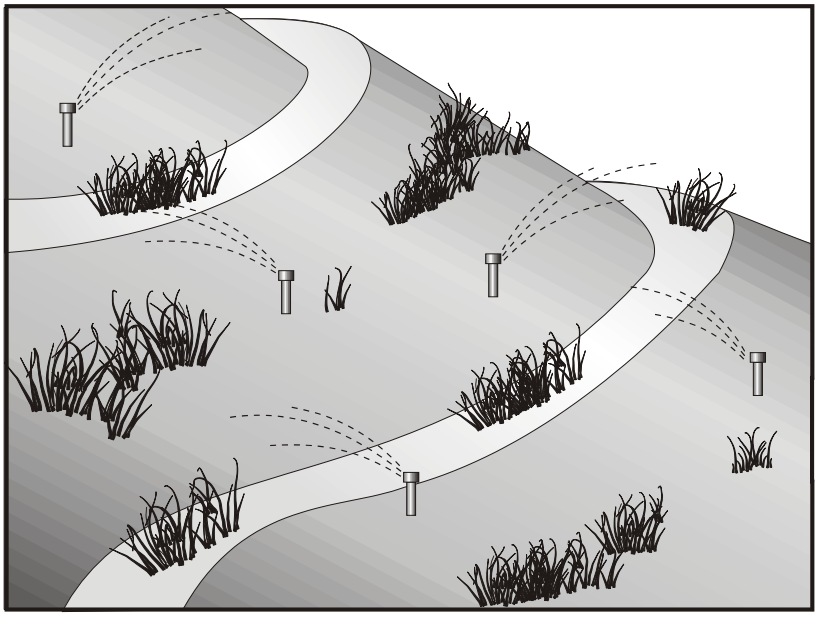
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Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Potable Water/Irrigation NS-7



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

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.

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Potable Water/Irrigation NS-7

- 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.

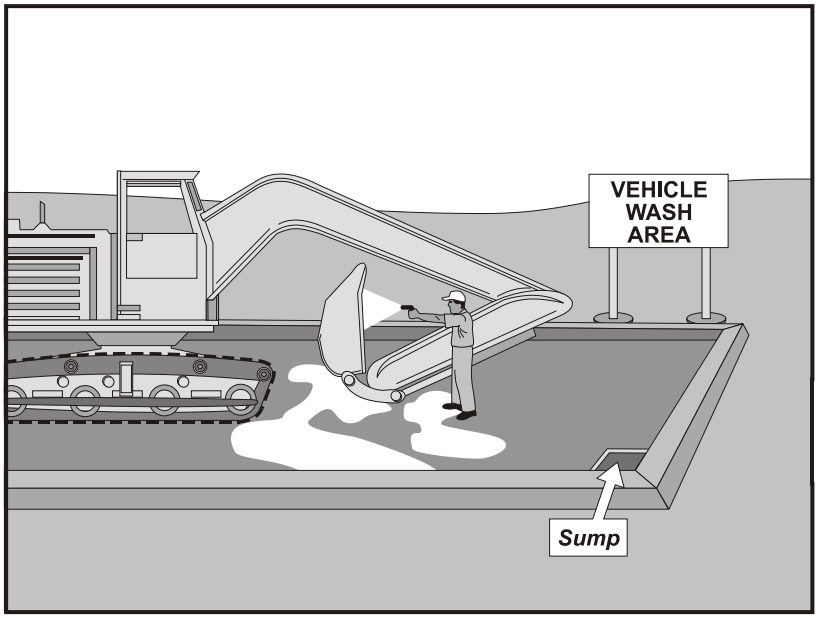
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Vehicle and Equipment Cleaning NS-8



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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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:

Vehicle and Equipment Cleaning NS-8

- 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 runon 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.

Vehicle and Equipment Cleaning NS-8

Inspection and Maintenance

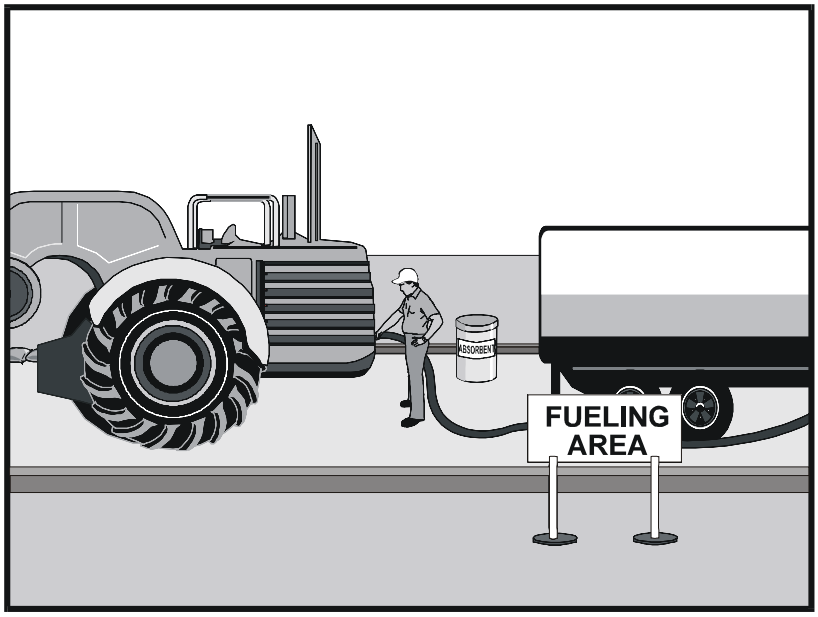
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at 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.

Vehicle and Equipment Fueling NS-9



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	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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.

Vehicle and Equipment Fueling NS-9

- 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 runon and 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 runon, 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.

Vehicle and Equipment Fueling NS-9

- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

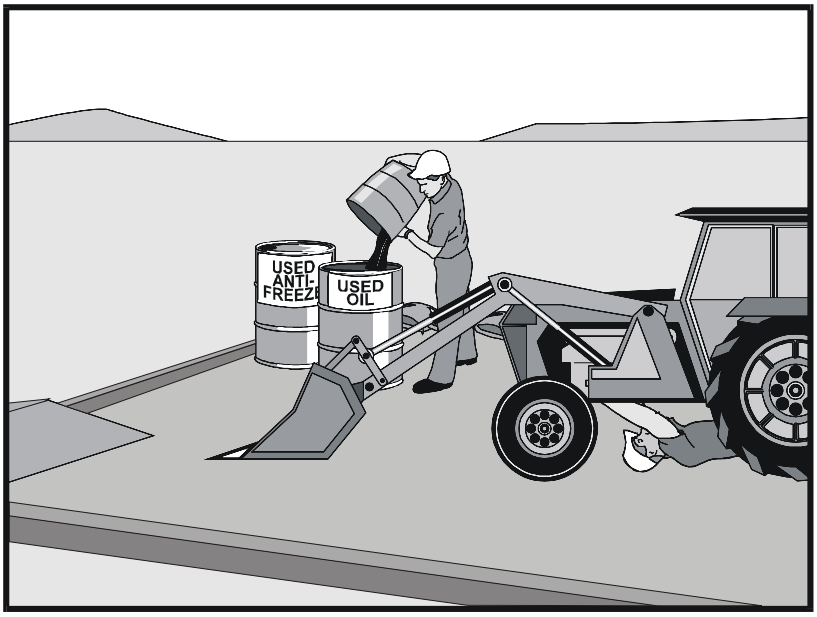
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Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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,

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Vehicle & Equipment Maintenance NS-10

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 runon and 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

- 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

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.

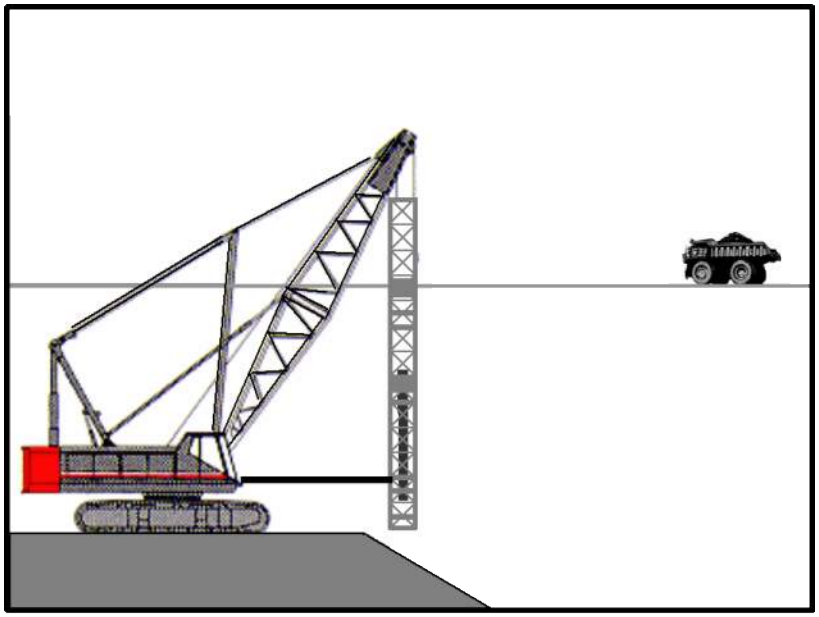
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Pile Driving Operations NS-11



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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.

Pile Driving Operations NS-11

- 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 runon 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

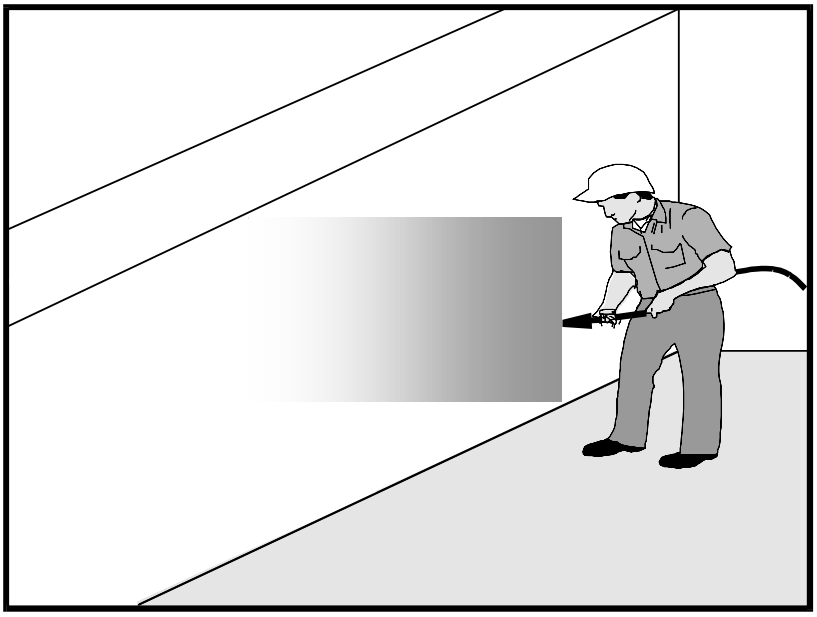
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- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect equipment every day at startup and repair equipment as needed (i.e., worn or damaged hoses, fittings, and gaskets). Recheck equipment at shift 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.

Concrete Curing NS-12



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	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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.

Concrete Curing NS-12

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.

Concrete Curing NS-12

- 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

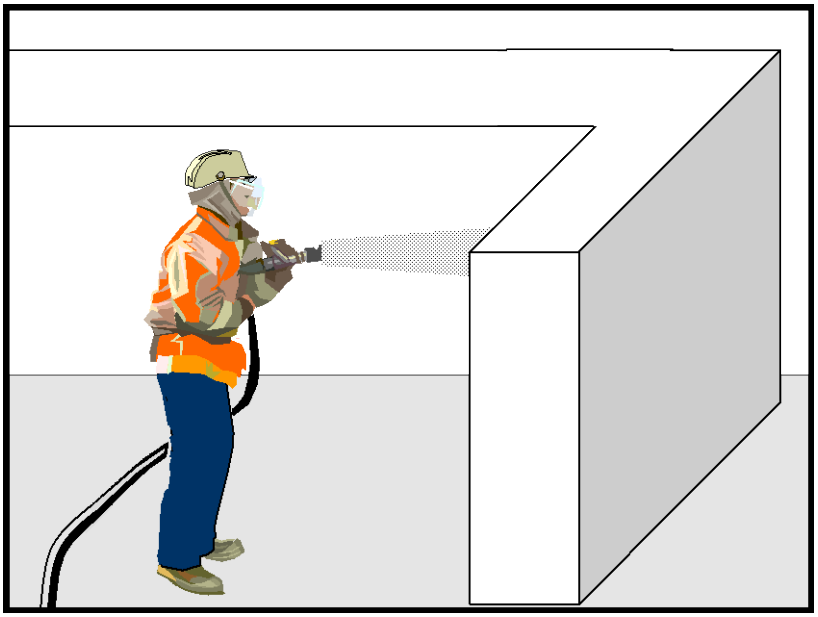
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non-Point Source Pollution Control Program, 1992.

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.

Concrete Finishing NS-13



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	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

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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.

Concrete Finishing NS-13

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.

Concrete Finishing NS-13

- 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.

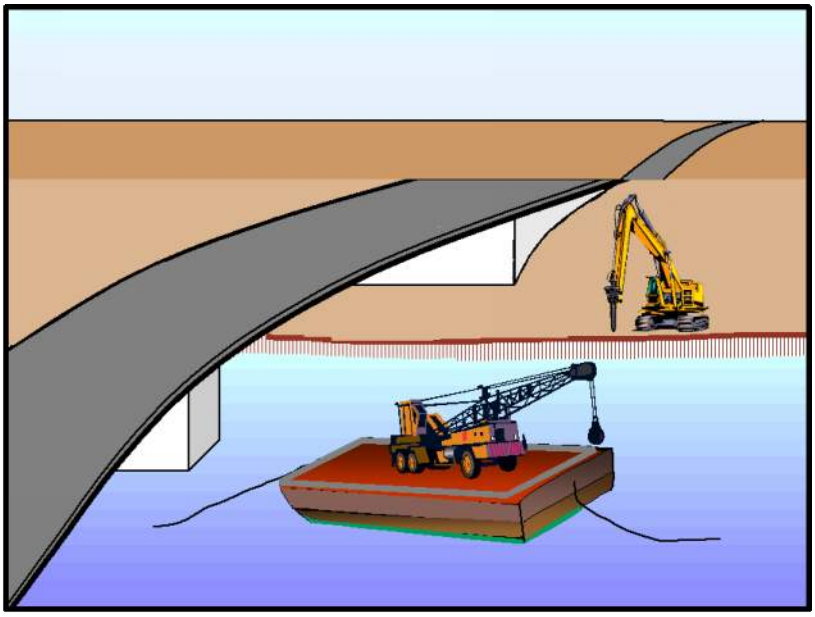
References

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.

Material Over Water NS-14



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	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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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

Material Over Water NS-14

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.

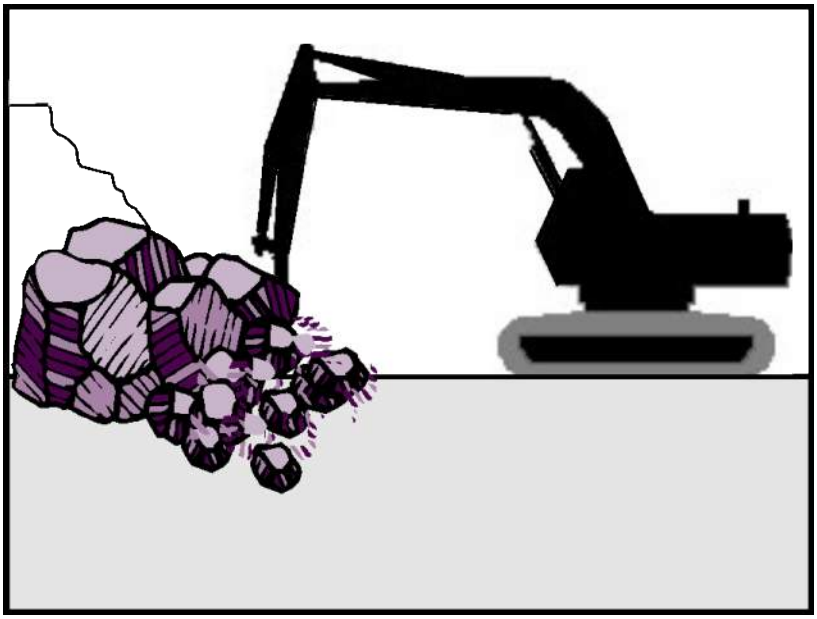
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Material Over Water NS-14

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Demolition Adjacent to Water NS-15



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	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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.

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Demolition Adjacent to Water NS-15

- 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 runon and 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.

Temporary Batch Plants NS-16



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	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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.

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Suitable Applications

These procedures typically apply to construction sites where temporary batch plant facilities are used; however, some of the

Temporary Batch Plants NS-16

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 runon 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.

Temporary Batch Plants NS-16

- 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.

Temporary Batch Plants NS-16

- 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.

Temporary Batch Plants NS-16

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

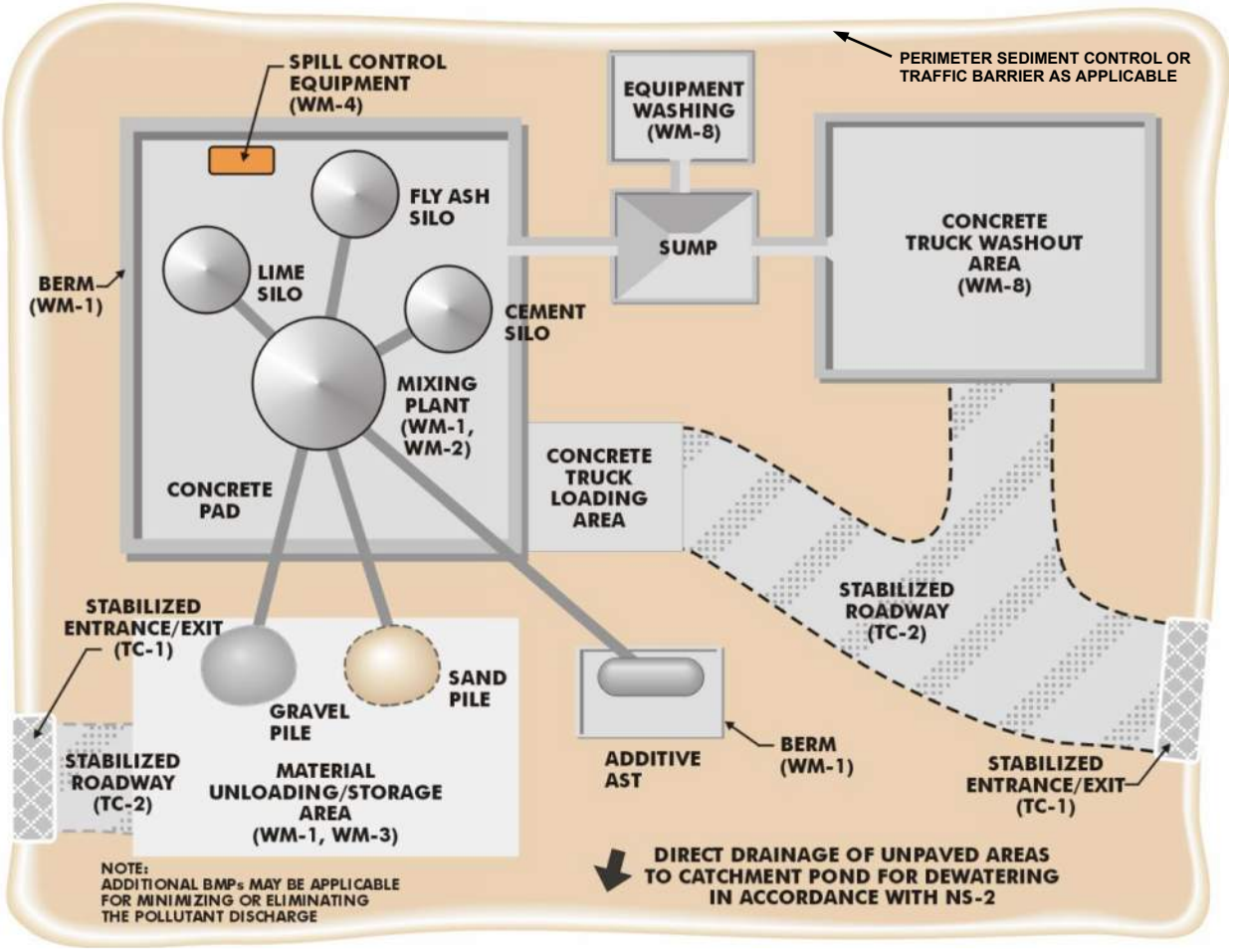
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to 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

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

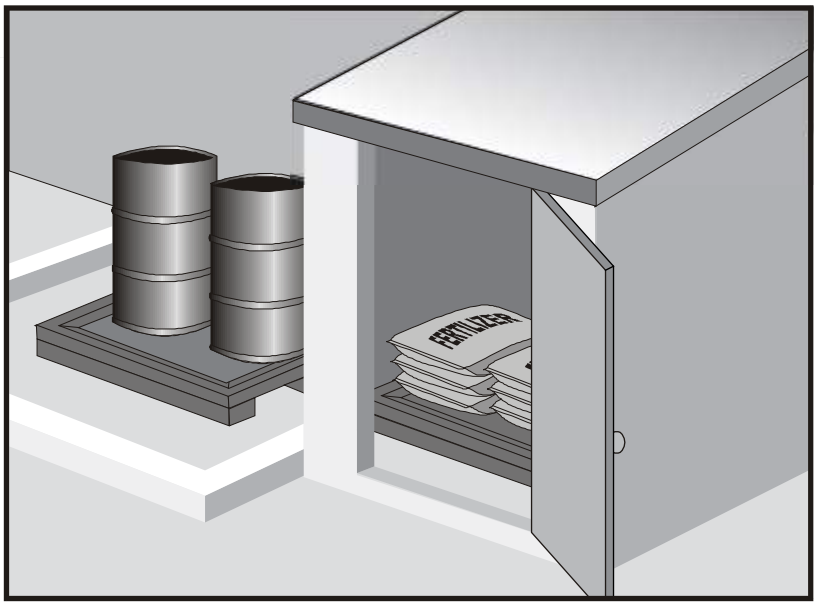
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Temporary Batch Plants NS-16



Typical Temporary Batch

Material Delivery and Storage WM-1



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	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

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

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Material Delivery and Storage WM-1

- 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.

Material Delivery and Storage WM-1

- 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.

Material Delivery and Storage WM-1

- 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.

Material Delivery and Storage WM-1

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

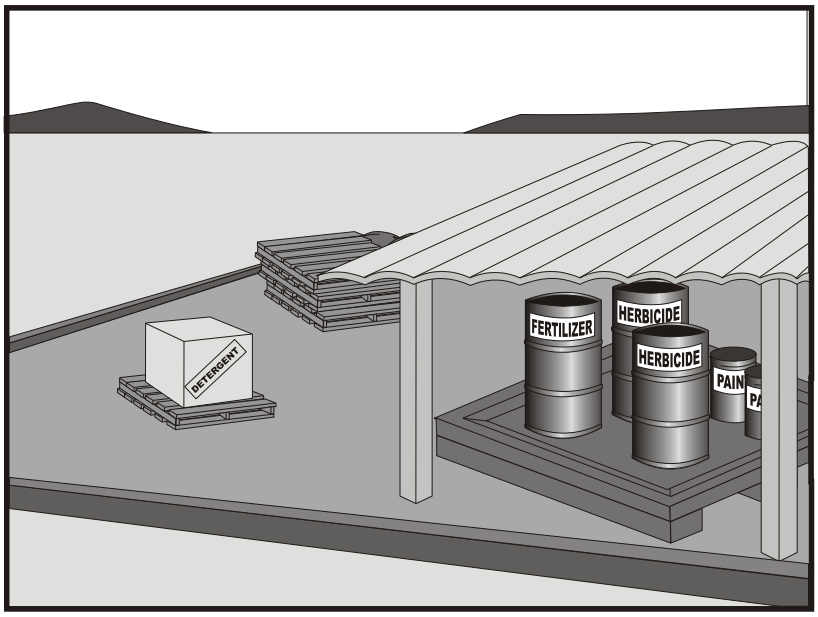
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Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

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.

Material Use WM-2



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	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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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

Material Use WM-2

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

Material Use WM-2

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.

Material Use WM-2

- 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.

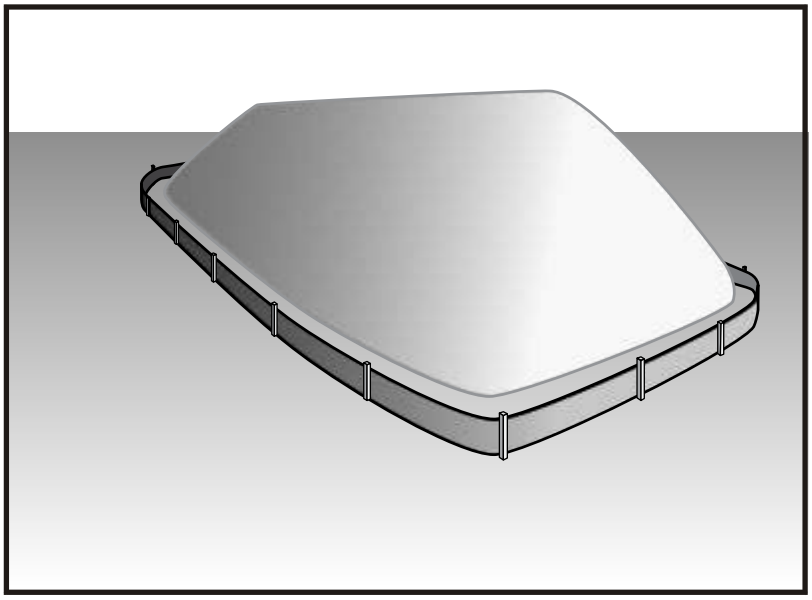
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Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management WM-3



Treat 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	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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:

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Stockpile Management WM-3

- 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

Stockpile Management WM-3

- 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.)

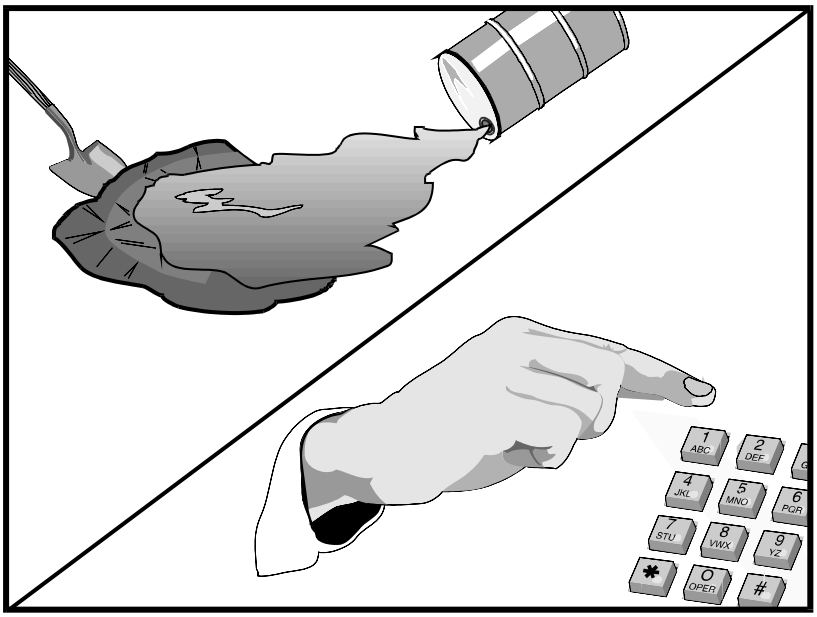
Inspection and Maintenance

- 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.

Spill Prevention and Control WM-4



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	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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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

Spill Prevention and Control WM-4

- 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 runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

Spill Prevention and Control WM-4

- 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.

Spill Prevention and Control WM-4

- 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:

Spill Prevention and Control WM-4

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 runon 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 runon 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.

Spill Prevention and Control WM-4

- 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.

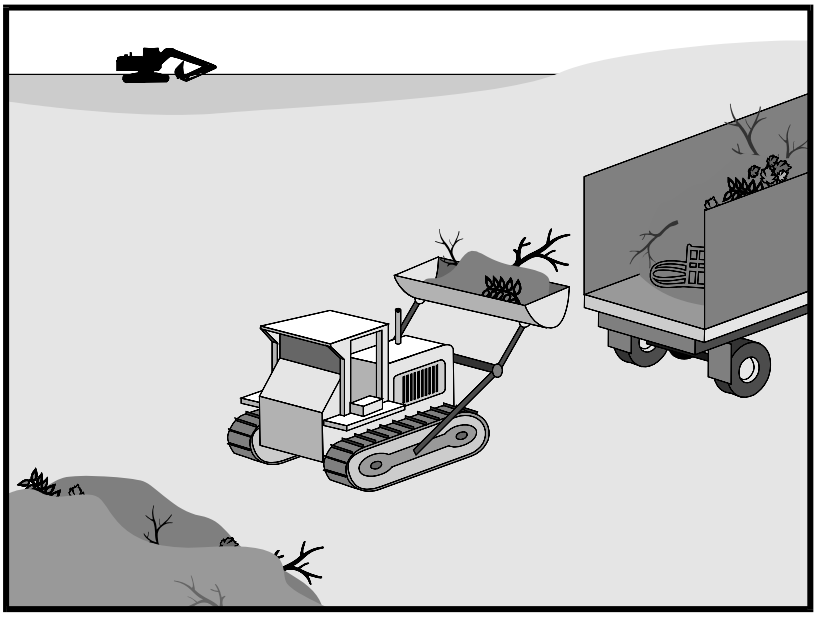
References

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Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



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	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Solid Waste Management WM-5

- 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.

Solid Waste Management WM-5

- 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 runon 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.

Solid Waste Management WM-5

- 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.

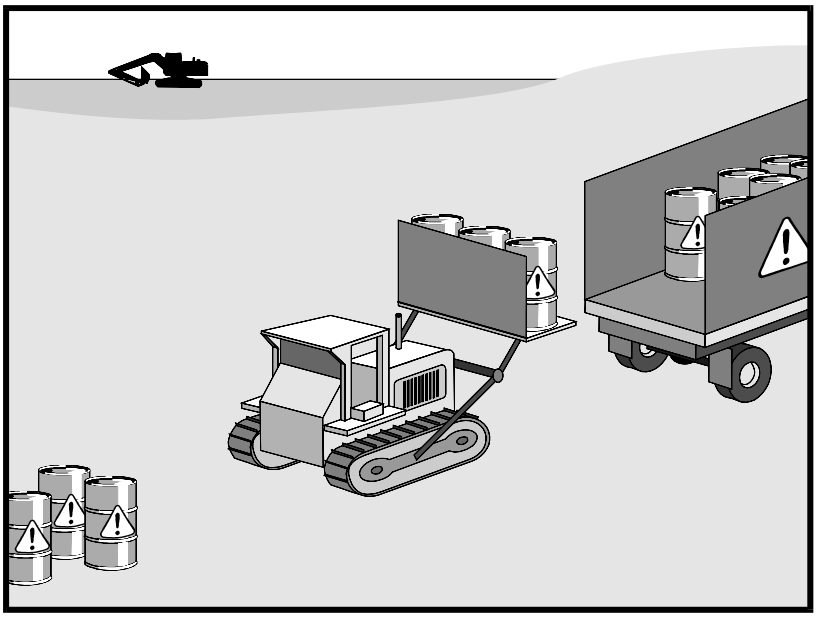
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Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



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	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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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
- Asphalt Products
- Concrete Curing Compounds
- Pesticides
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- 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

Hazardous Waste Management WM-6

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.

Hazardous Waste Management WM-6

  - 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.

Hazardous Waste Management WM-6

- 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.

Hazardous Waste Management WM-6

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 Waste Management WM-6

- 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

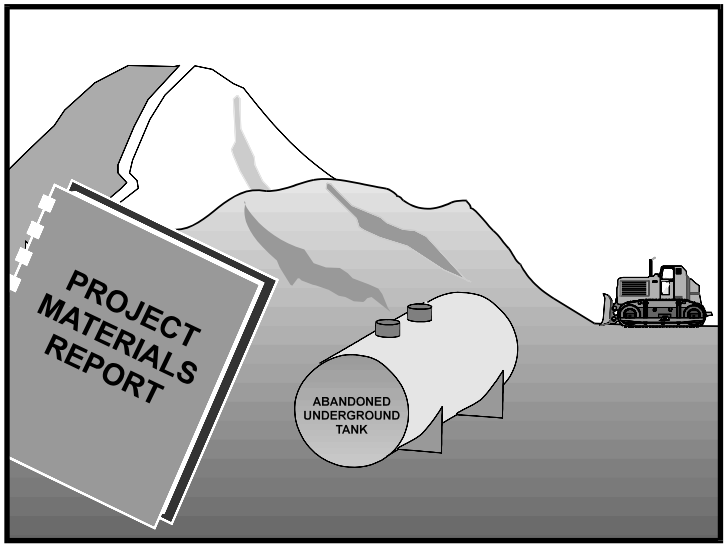
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Contaminated Soil Management WM-7



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	☑

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	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Contaminated Soil Management WM-7

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.

Contaminated Soil Management WM-7

- 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)

Contaminated Soil Management WM-7

- 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.

Contaminated Soil Management WM-7

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

References

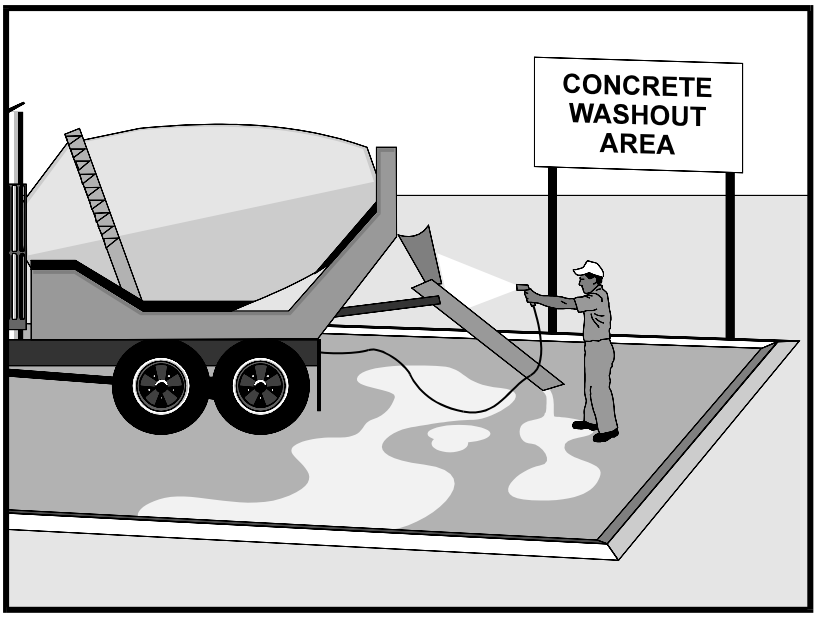
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Concrete Waste Management WM-8



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	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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.

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Concrete Waste Management WM-8

- 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.

Concrete Waste Management WM-8

- 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.

Concrete Waste Management WM-8

- 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.

Concrete Waste Management WM-8

- 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.

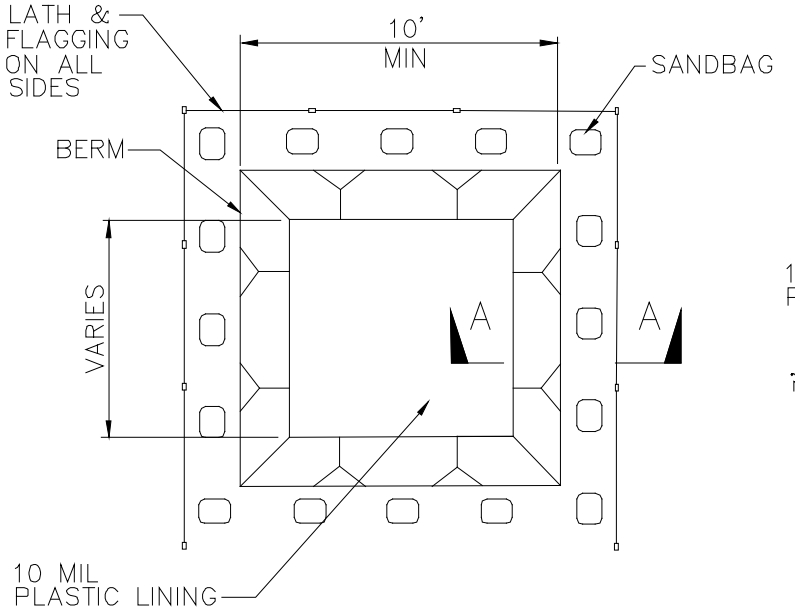
References

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.

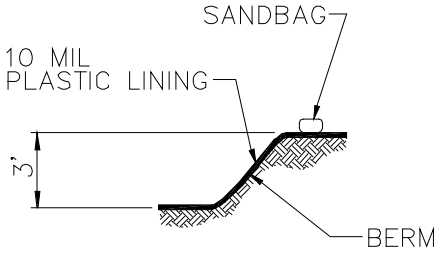
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000, Updated March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

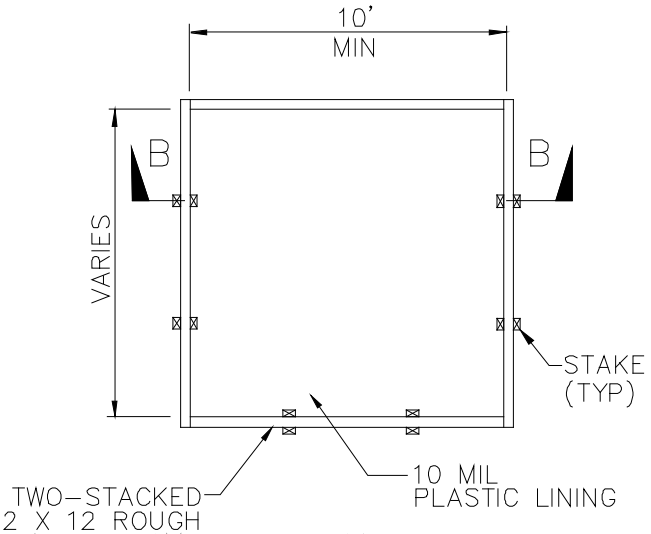
Concrete Waste Management WM-8



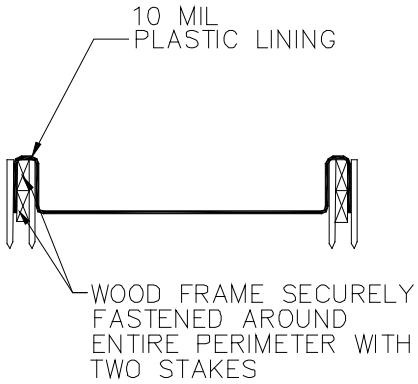
PLAN
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SECTION A–A
NOT TO SCALE



PLAN
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TYPE "ABOVE GRADE"

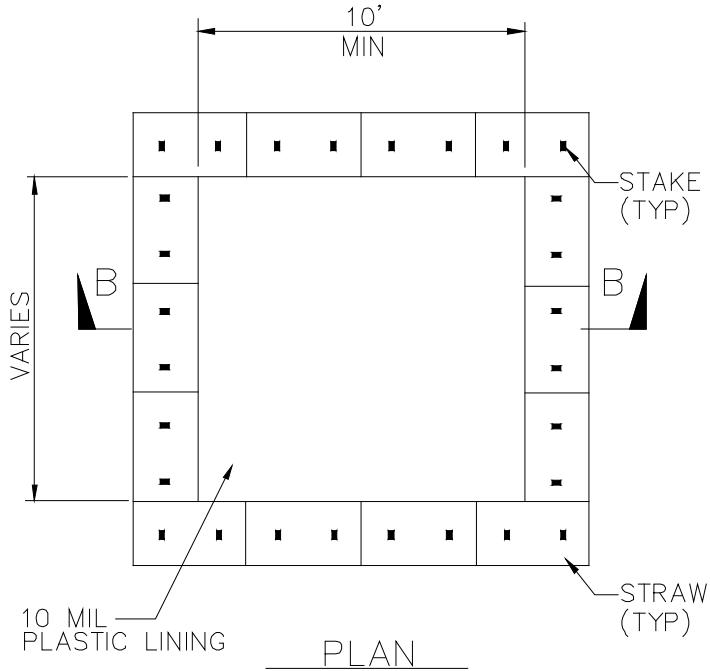


SECTION B–B
NOT TO SCALE

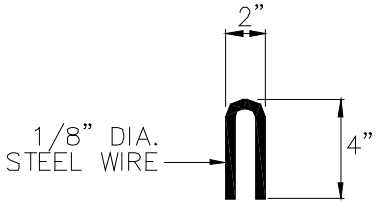
NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

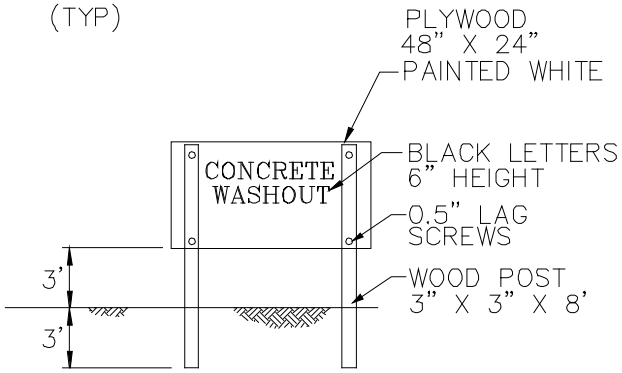
Concrete Waste Management WM-8



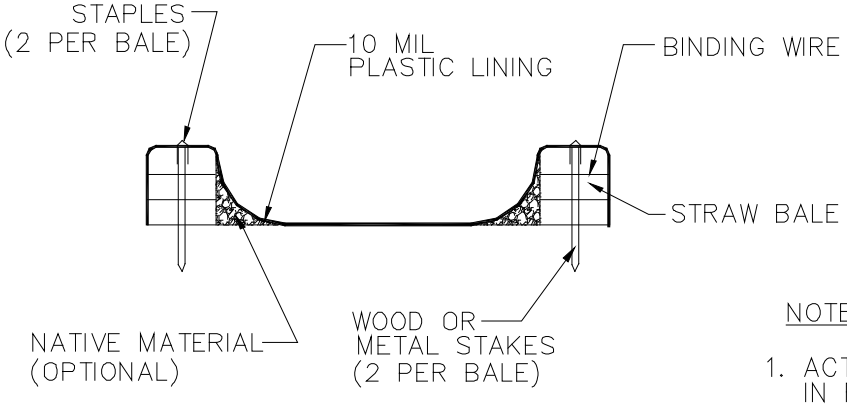
PLAN
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WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

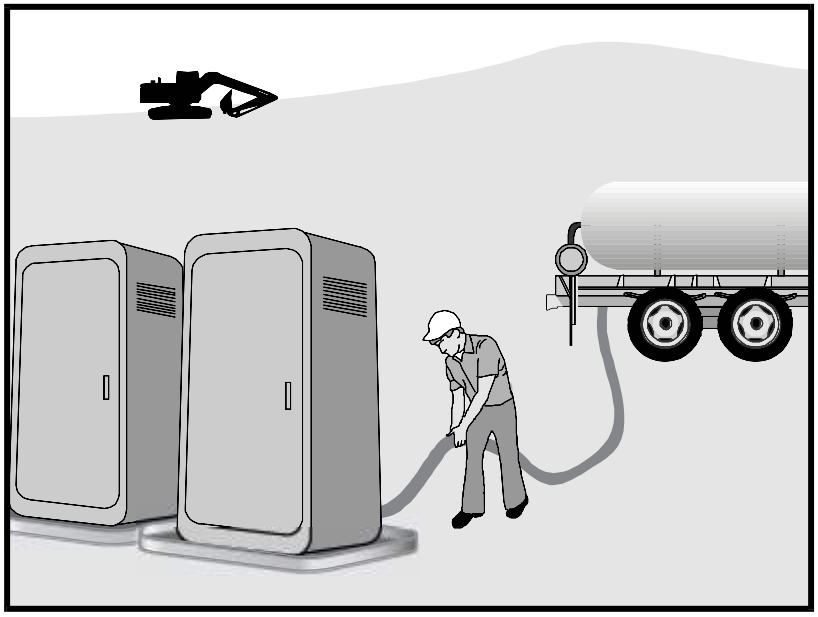


SECTION B–B
NOT TO SCALE

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



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	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

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.

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

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Sanitary/Septic Waste Management WM-9

- 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

Inspection and Maintenance

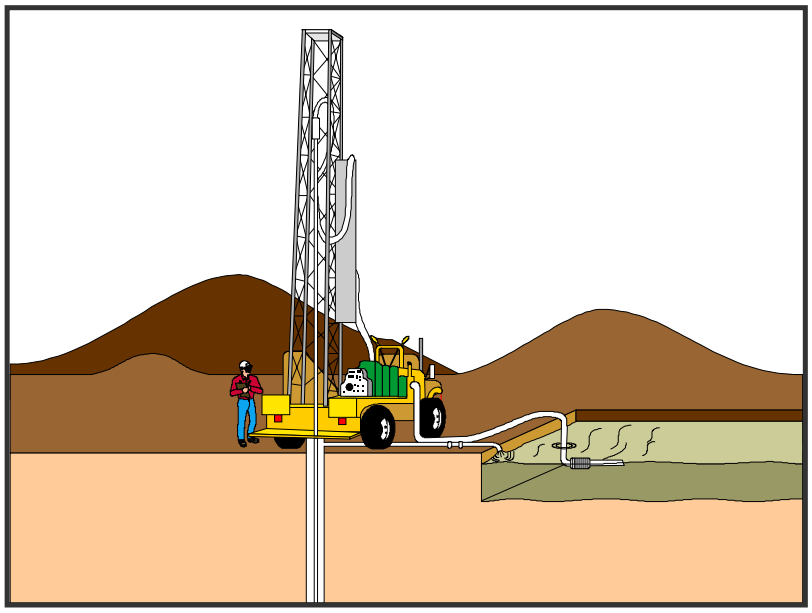
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange 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.

Liquid Waste Management WM-10



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	☑

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Liquid Waste Management WM-10

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.

Liquid Waste Management WM-10

- 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.

Liquid Waste Management WM-10

- 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.

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 MS4under 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.

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 CERLCA; 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 handing, 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

BMP INSPECTION REPORT

Date and Time of Inspection:			Date Report Written:		
Inspection Type: (Circle one)	Weekly *Complete Parts I,II,III and VII*	Pre-Qualifying Precipitation Event (QPE) *Complete Parts I,II,III,IV and VII*	During QPE *Complete Parts I, II, III, V, and VII*	Post-QPE *Complete Parts I,II,III,VI and VII*	*Inactive Project Complete Parts I,II,III and VII*

Part I. General Information

Site Information

Construction Site Name: Sanger Education Center – Phase 3

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)

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)
If yes, summarize forecast:

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:

Part II. BMP Observations. Describe deficiencies in Part III.

Minimum BMPs for Risk Level _____ Sites	Adequately designed, implemented and effective (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Construction Materials			
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			
Good Housekeeping for Waste Management			
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			
Good Housekeeping for Vehicle Storage and Maintenance			
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			

Part II. BMP Observations Continued. Describe deficiencies in Part III.			
Minimum BMPs for Risk Level _____ Sites	Adequately designed,	Action Required (yes/no)	Action Implemented (Date)

	implemented and effective (yes, no, N/A)		
Good Housekeeping for Landscape Materials			
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			
Good Housekeeping for Air Deposition of Site Materials			
Good housekeeping measures are implemented onsite to control the air deposition of site materials and from site operations			
Non-Stormwater Management			
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.			
Erosion Controls			
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.			
Sediment Controls			
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 an 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 the reduce their effectiveness (Risk Level 2 & 3 Only)			
Run-On and Run-Off Controls			

Run-on to the site is effectively managed and directed away from all disturbed areas.			
Other			
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?			

Part III. Descriptions of BMP Deficiencies		
Deficiency	**Repairs Implemented: Note - Repairs must begin within 72 hours of identification and, complete repairs as soon as possible.**	
	Start Date	**Action**
1.		
2.		
3.		
4.		

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).	
	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:	

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.
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

Contractor Personnel Training Log

Stormwater Management Training Log and Documentation

Project Name: Sanger Education Center – Phase 3

WDID#: **5F10C408288**

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: Sanger Education Center – Phase 3

WDID#: **5F10C408288**

QSP Delegate Name: _____

Delegated Responsibilities:

☐ Stormwater Visual Inspections

☐ Sampling

☐ BMP Inspections

☐ BMP Maintenance and Repair

Foundational Training

Topic	Date Completed	QSP Trainer
☐ Roles and Responsibilities		
☐ Forecast Information		
☐ Documentation and Reporting Procedures		

Site-Specific Training

Topic	Date Completed	QSP Trainer
☐ Visual Inspections		
☐ Sample Collection Procedures		
☐ Sample Reporting Procedures		
☐ BMP Implementation		

As needed, attach proof of external training (e.g., course completion certificates, credentials for the QSP Delegate).

Appendix J: Responsible Parties

CERTIFICATE OF TRAINING

CALIFORNIA CONSTRUCTION GENERAL PERMIT

Qualified SWPPP Developer (QSD)

AND

Qualified SWPPP Practitioner (QSP)

Michael Gennaro

July 1, 2025 - August 28, 2027

Certificate #28547

CASQA

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

California Stormwater Quality Association and
California Construction General Permit Training Team

CERTIFICATE OF TRAINING

CALIFORNIA CONSTRUCTION GENERAL PERMIT

Qualified SWPPP Developer (QSD)

AND

Qualified SWPPP Practitioner (QSP)

Gabriel Ledesma

August 7, 2026 - August 15, 2028

Certificate #28909

CASQA

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

California Stormwater Quality Association and
California Construction General Permit Training Team

CERTIFICATE OF TRAINING

CALIFORNIA CONSTRUCTION GENERAL PERMIT

Qualified SWPPP Developer (QSD)

AND

Qualified SWPPP Practitioner (QSP)

Alycia Magana

September 1, 2026 - September 1, 2028

Certificate #85204

CASQA

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

California Stormwater Quality Association and
California Construction General Permit Training Team

Identification of QSP and QSP Delegates

Project Name: Sanger Education Center – Phase 3

WDID#: **5F10C408288**

The following are QSPs and QSP Delegates associated with this project

Name of Personnel(1)	QSP Number, or state "Delegate"	Company	Date
Alan Mok	00362	Alan Mok Engineering	08/01/25
Cesar Rocha	Delegate	Harris Construction	08/01/25

(1) If additional QSPs or QSP Delegates are required on the job site add additional lines

Appendix K: Contractors and Subcontractors

Prime Contractor/Construction Management Company:

Contractor Company:	Harris Construction Co., Inc.
Contractor Lead Name:	Steven Valdez
Title:	Project Manager
Address	5286 E. Home Avenue, Fresno, CA 93727
Phone Number:	559-251-0301
Phone Number (24/7)	559-217-4630

Sub-Contractors:

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Company:	
Scope of Work:	
Sub-Contractor Lead Name:	
Title:	
Address	
Phone Number:	
Phone Number (24/7)	

Appendix L: Post-Construction Calculations/ Demonstration

Blair, Church & Flynn
CONSULTING ENGINEERS

Gabriel Ledesma, QSD, CPESC · gledesma@bcf-engr.com
451 Clovis Ave, Suite 200 · Clovis CA 93612 · Tel (559) 326-1400

MEMORANDUM

To: SWRCB
From: Gabriel Ledesma

Date: 07/31/2025
WDID#.: TBD

Subject: Sanger Ed Center – Phase 3 & Aquatics - Post-Construction Compliance Demonstration

This memo is to demonstrate compliance with the FMFCD Phase I MS4 post-construction requirements for the Sanger Ed Center – Phase 3 & Aquatics 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 "BL", 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



Fresno Metropolitan Flood Control District

5469 E. Olive Avenue · Fresno, CA 93727
(559) 456-3292 · Fax (559) 456-3292
www.fresnofloodcontrol.org

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).

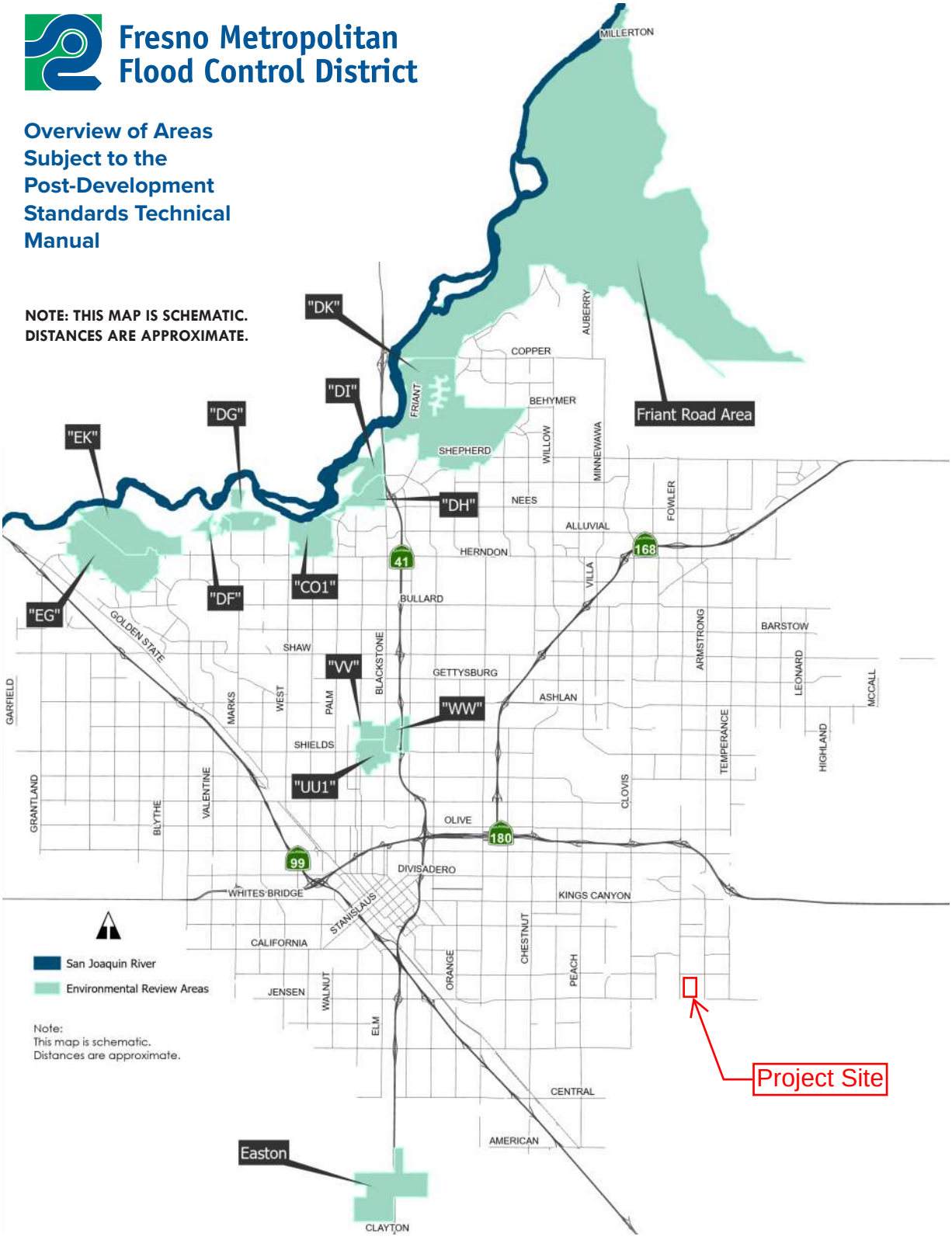
Next Steps

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.



Appendix M: Weather Reports

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

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

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:	☐ Weekly	☐ Pre Qualifying Precipitation Event (QPE)	☐ During QPE	☐ Post QPE	☐ Dewatering Discharge
Site Information					
Construction Site Name:					
Construction stage and completed activities:				Approximate area of exposed site:	
Weather and Observations					
Date Rain Predicted to Occur:			Predicted % chance of precipitation (PoP): Predicted quantity of precipitation (QPF):		
Estimate storm beginning: _____ (date and time)		Estimate storm duration:_____ (hours)	Estimate time since last storm: _____ (days or hours)	Rain gauge reading:_____ (inches)	
Observations: If yes identify location					
Odors	Yes ☐	No ☐			
Floating material	Yes ☐	No ☐			
Suspended Material	Yes ☐	No ☐			
Sheen	Yes ☐	No ☐			
Discolorations	Yes ☐	No ☐			
Turbidity	Yes ☐	No ☐			
Site Inspections					
Outfalls or BMPs Evaluated			**Deficiencies Noted**		
(add additional sheets or attached detailed BMP Inspection Checklists)					
Photos Taken:	Yes ☐	No ☐	Photo Reference IDs:		
Corrective Actions Identified (note if SWPPP change is needed)					
Inspector Information					
Inspector Name:			Inspector Title:		
Signature:				Date:	

Risk Level 1, 2, 3 ***Effluent Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Sampling Event Type:	☐ Stormwater	☐ Dewatering Discharge	☐ Non-visible pollutant
Field Meter Calibration			
pH Meter ID No./Desc.: Calibration Date/Time:		Turbidity Meter ID No./Desc.: 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:
Time End:

Risk Level 3 ***Receiving Water Sampling Field Log Sheets***		
Construction Site Name:	Date:	Time Start:
Sampler:		
Receiving Water Description and Observations		
Receiving Water Name/ID:		
Observations:		
Odors Yes ☐ No ☐		
Floating material Yes ☐ No ☐		
Suspended Material Yes ☐ No ☐		
Sheen Yes ☐ No ☐		
Discolorations Yes ☐ No ☐		
Turbidity Yes ☐ No ☐		
Field Meter Calibration		
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: 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 ☐ pH ☐ Turbidity** **☐ Other (specify) _____**
Measurement or Analytical Method	**☐ Field meter** **(Sensitivity: _____)** **☐ Lab method (specify) _____** **(Minimum Level: _____)** **(MDL: _____)**
Calculated Daily Average	**☐ pH _____ pH units** **☐ Turbidity _____ NTU**
Rain Gauge Measurement	**_____ inches**
Visual Observations on Day of Exceedance	

NAL Exceedance Evaluation Summary Report	**Page __ of __**
Description of BMPs in Place at Time of Event	
Initial Assessment of Cause	
Corrective Actions Taken (deployed after exceedance)	
Additional Corrective Actions Proposed	
Report Completed By	_____ **(Print Name, Title)**
Signature	_____

CHAIN-OF-CUSTODY **DATE:** **Lab ID:**

DESTINATION LAB: ATTN: **ADDRESS:** **Office Phone:** **Cell Phone:**							REQUESTED ANALYSIS				Notes:
SAMPLED BY:											
Contact:											
Project Name											
Client Sample ID	**Sample Date**	**Sample Time**	**Sample Matrix**	**Container #**	**Container Type**	**Container Pres.**					

SENDER COMMENTS:	**RELINQUISHED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:
LABORATORY COMMENTS:	**RECEIVED BY**	
	Signature:	
	Print:	
	Company:	
	Date:	TIME:

Appendix P: Field Meter Instructions

Appendix Q: Supplemental Information

Appendix R: Construction General Permit

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.

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. 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.

B. 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.

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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:

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A. Copper, 600 volt rated throughout. Conductors 12AWG to 10AWG. 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. Neutrals shall be solid white with color stripe as indicated.

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C. Color Code Conductors as Follows:

		Phase			Neutral		Ground
	A Ph	B Ph	C Ph	A Ph	B Ph	C Ph	
208/120V							
3 Ph	Blk	R/Blk	BL	W/Blk	N.A.	W/BL	Grn
240/120V							
1 Ph	Blk	R	N.A.	W/Blk	W/R	N.A.	Grn
480/277V	Brn	Org	Yel	Gry/Brn	Gry/Org	Gry/Yel	Grn
Blk = Black, R = Red, BL = Blue, Grn = Green, Brn = Brown, Org = Orange, Yel = Yellow, Gry = Grey, W = White							

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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, 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 (waterproof, wet location, plenum, temperature rated, etc.). 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.

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.

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C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 12 through 10AWG.

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 are not allowed.

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 pullboxes 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).
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

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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. Floor boxes and poke-through.
6. Cabinets, termination cabinets.
7. Gutters.
8. 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 on site and offsite, 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, controls, fire alarm, power distribution, lighting, lighting controls, and other building low voltage/communications systems controls as may be required. Raceways, boxes and duct paths required for utility companies shall be installed per plans unless utility company requirements are more restrictive at which time those requirements shall take precedence.
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

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obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, perlins, 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. Conduits shall have minimum cover requirement of 36" below finish grade. Refer to details on drawings for conduits in trench requirements. Locations of existing underground (UG) utility systems shall be determined by calling Underground Service Alert (USA) at least 48 hours prior to any excavation. Also refer to Section 26 05 46.13, ELECTRIC UTILITY SYSTEMS.
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 lighting, electrical, fire alarm and emergency radio responder radio coverage systems shall be installed in a metallic conduit system dedicated to each type of system. Open cabling is allowed for telecom/data, audio/visual and low voltage lighting control cabling only.
10. All line voltage wiring within the building shall be installed in metallic conduit systems.
11. All conduit, concrete pads, underground concrete 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 systems including lighting, lighting controls, power distribution, fire alarm, etc. shall be in dedicated conduit systems.
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 system.
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.

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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 and poke-through.
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 PVC Coated, 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 color coded as indicated, 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.

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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. Manufacturers:
1. Outlet Boxes: Bowers, Raco, Steel City or equal.
2. Weatherproof Outlet Boxes: Bell, Red Dot, [Carlon] or equal.
3. Floor Boxes: 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 Liquatite or equal.
15. Floor Boxes, Single Gang, Walker/Wiremold 880 CS Series or approved equal.
16. Floor Boxes, Multiple Gang, Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers.
17. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
18. Floor Boxes, Poke-Thru, Hubbell PT7 Series, Walker/Wiremold RC4 Series, or approved equal unless otherwise noted.
19. Floor Boxes, Poke-Thru, Furniture Feed, Walker/Wiremold RC9 Series or approved equal.
20. 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. Refer to drawings for data/communication outlet boxes.

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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. Construction: Provide corrosion-resistant cast iron, with zinc finish, weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, zinc, galvanized finish.

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 406.9 (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.

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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: Cast iron with gasket.

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 FLOOR BOXES - SINGLE GANG

A. Construction: Deep cast iron fully adjustable before and after concrete pour with all required components for complete activation. Verify required components for application of service fittings, covers, monuments, and the like, attached to floor boxes.

B. Activations:
1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
2. Monuments: Provide stainless steel monuments with power receptacle or data grommet as noted.
3. Coordinate specific application of systems as noted on Drawings.

C. Location: Concrete floor. Use poke-thru of same construction in non-concrete structure. Verify exact locations. Ensure flush with finish surface.

2.8 FLOOR BOXES - MULTIPLE GANG

A. Construction: Deep cast iron, fully adjustable before and after pour. Equal to Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers. Verify color. Partition for different power or signal applications. Provide required power receptacle devices and signal grommets or receptacles as noted. Flange type shall be compatible with floor covering for either carpet or vinyl as required and shall be brass type not polycarbonate.

B. Floor mounted boxes shall be water tight and cast iron when installed in grade level concrete slab floor, fully adjustable with interior and exterior leveling screws. Receptacle flange shall be

brass with a duplex lift lid. Flange type shall be compatible with floor type. Before installation, coordinate exact location with Architect.

2.9 FLOOR BOXES - POKE-THRU

A. Fire rated for 4 hour, dual service, flush brass cover and service fitting prewired specification grade receptacle, voice/data jacks, as specified.

B. Furniture Feed: Fire rated per floor assembly rating, finish flange and service head assembly.

2.10 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. . Pull boxes 24” x 36” and larger shall have full bottom, set on a minimum of 24” of crushed rock with drainage as detailed on plans.

B. Flushmount in hardscape and 1” above grade in softscape.

C. Provided with full vehicular type cover, stamped with “ELECTRIC”, “LIGHTING”, COMMUNICATIONS”, etc. cover identification as shown on the drawings or as applicable.

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.

2.11 IN-GRADE UTILITY COMPANY BOXES AND VAULTS

A. In-grade boxes and pads for utility company, shall be as specified by the respective utility company with all of the company’s requirements and construction methods met.

2.12 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. All Metallic Conduit installed below grade shall be PVC coated type.

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.

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 Pvc Coated Type..

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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 physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits. EMT shall be color coded as follows: Yellow – 277/480Volts, Red – Fire Alarm Circuits, Silver – 120/208Volts, Blue – Low Voltage Circuits (Under 50Volts).

E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual run from distribution panel to last device shall exceed a cumulative length of 6’ 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.

F. Underground conduits and transition to above grade/slab shall be:
   1. GRS elbows.
   2. GRS risers from GRS elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
   3. GRS elbows/risers to be PVC coated.

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. 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.

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" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.

L. 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.

M. 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.

N. 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.

O. 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.

P. 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.

Q. 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.

R. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

S. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

T. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.

U. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

V. Mount heights of outlet boxes, unless otherwise required by ADA, shall be as noted on drawings.

W. 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.

X. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

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Y. 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

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SECTION 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION

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. Overcurrent Protective Device Coordination.
   2. A short circuit and coordination study shall be prepared for the electrical overcurrent devices to be installed under this project to assure selective coordination, proper equipment and personnel protection.
   3. The study shall present an organized time current analysis of each protective device in series from the individual overcurrent device back to the utility and the on-site generator sources. The study shall reflect the operation of each device during normal and abnormal current conditions.
   4. Implement as part of this contract, all manufacturer's recommendations for maximum protection and best selective coordination at no additional cost to Owner.
   5. The Contractor shall furnish an ARC Flash analysis study per NFPA 70E – Standard For Electrical Safety In The Workplace, Reference Article 130.3 and Appendix D.

B. Related Work:
   1. Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.
   2. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

1.3 SUBMITTALS

A. In accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL, submit the following:
   1. Complete short circuit and coordination study as described herein.
   2. Protective equipment submittals and shop drawings may be submitted at the same time or prior to completion of the overcurrent protective device study. If equipment submittals / shop drawings are submitted prior to completion of the overcurrent protective device study for the benefit of schedule acceleration. Contractor shall provide written acknowledgment that device ratings provided in equipment submittals / shop drawings are contingent upon finalization of protective device study. Such acknowledgement will allow for equipment procurement concurrent with protective device study, but does not absolve the Contractor from providing equipment that complies with the requirement of the overcurrent protective device study.

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3. Certification: Two weeks prior to final inspection, submit four copies of the following to the Engineer:
   a. Certification by the Contractor that the protective devices have been adjusted and set in accordance with the approved protective device study.
   b. Final setting values for each adjustable trip device.

1.4 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

C. The National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.5 QUALIFICATIONS

A. The protective device study shall be prepared by qualified engineers of the switchgear manufacturer or an approved consultant. The Contractor is responsible for providing all pertinent information required by the preparers to complete the study. Submit engineer's qualifications with study.

1.6 REQUIREMENTS

A. The complete study shall include a system one line diagram, short circuit and ground fault analysis, and protective coordination plots.

B. One Line Diagram:
1. Show on a single line diagram, all electrical equipment and wiring to be protected by the overcurrent devices installed under this project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
2. Also show on the one line diagram the following specific information:

a. Calculated fault impedance, X/R ratios, and short circuit values at each bus.
b. Breaker and fuse ratings.
c. Generator kW and Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
d. Voltage at each bus.
e. Identification of each bus.
f. Conduit material, feeder sizes, length, and X/R ratios.

C. Short Circuit Study:
1. Systematically calculate the fault impedance to determine the available short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
2. The study shall be calculated by means of a computer program. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.
3. Present the data determined by the short circuit study in a table format. Include the following:
a. Device identification.
b. Operating voltage.
c. Protective device.
d. Device rating.

D. Calculated short circuit current.

E. Coordination Curves:
1. Prepare the coordination curves to determine the required settings of protective devices to assure selective coordination. Graphically illustrate on log paper that adequate time separation exists between series devices, including the utility company upstream device. Plot the specific time current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.
2. The following specific information shall also be shown on the coordination curves:
a. Device identification.
b. Voltage and current ratio for curves.
c. 3-phase and 1-phase ANSI damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum short circuit cutoff point.
3. Develop a table to summarize the settings selected for the protective devices. Include the following in the table:
a. Device identification.
b. Relay CT ratios, tap, time dial, and instantaneous pickup.
c. Circuit breaker sensor rating, long time, short time, and instantaneous settings, and time bands.
d. Fuse rating and type.
e. Ground fault pickup and time delay.

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1.7 ANALYSIS

A. Analyze the short circuit calculations, and highlight any equipment that is determined to be underrated as specified. Propose approaches to effectively protect the underrated equipment.

B. After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination.

1.8 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

A. Necessary final field adjustments, settings and modifications shall be made by the contractor to conform with the protective device study without additional cost to the Owner.

B. All final circuit breaker and relay settings and fuse sizes shall be made by the manufacturer and contractor in accordance with the recommendations of the protective device study.

PART 2 - PRODUCTS

2.1 STUDIES

A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved consultant.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Contractor shall contact PG&E and verify available fault current delivered to the site and all other utility company information pertaining specific to this project and include in study.

C. Source combination may include present and future motors and generators.

D. Load data utilized shall include proposed loads obtained from contract documents provided by Owner, Contractor, and PG&E.

E. Include fault contribution of existing motors in the study, with motors greater than 5 hp. The Contractor shall obtain required equipment data, to satisfy the study requirements.

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2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVAULATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:
1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three phase bolted fault at each:
1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Unit substation primary and secondary terminals.
4. Low voltage switchgear.
5. Motor control centers.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.
8. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line to ground fault current study for areas as defined for the three phase bolted fault short circuit study.

F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short circuit stresses
3. Adequacy of transformer windings to withstand short circuit stresses
4. Cable and busway sizes for ability to withstand short circuit heating
5. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the curve sheets, where applicable:
1. Electric utility's protective device.
2. Medium voltage equipment relays.
3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands.
5. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters.
6. Conductor damage curves.
7. Ground fault protective devices, as applicable.
8. Pertinent motor starting characteristics and motor damage points.
9. Pertinent generator short-circuit decrement curve and generator damage point.
10. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D.

B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short circuit and coordination study model. Alternative methods shall be presented in the proposal.

C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

D. The Arc-Flash Hazard Analysis shall include all equipment and locations as part of this project.

E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

F. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

G. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

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H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2.

2.6 REPORT SECTIONS

A. Input Data:
1. Short-circuit reactance of rotating machines
2. Cable and conduit materials
3. Bus ducts
4. Transformers
5. Reactors
6. Aerial lines
7. Circuit resistance and reactive values.

B. Short-Circuit Data:
1. Source fault impedance and generator contributions
2. X to R ratios
3. Asymmetry factors
4. Motor contributions
5. Short circuit kVA
6. Symmetrical and asymmetrical fault currents.

C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
    a. Current transformer ratio
    b. Current setting
    c. Time setting
    d. Instantaneous setting
    e. Specialty non-overcurrent device settings
    f. Recommendations on improved relaying systems, if applicable.
2. Circuit Breakers:
    a. Adjustable pickups and time delays (long time, short time, ground)
    b. Adjustable time-current characteristic
    c. Adjustable instantaneous pickup
    d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations
1. Arcing fault magnitude
2. Device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

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PART 3 - EXECUTION

3.1 EQUIPMENT AND FIELD ADJUSTMENTS

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A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Contractor to make all necessary modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies and include all recommendations at no additional cost to owner.

C. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.2 ARC FLASH WARNING LABELS

A. The Contractor shall provide a 3 1/2" x 5” thermal transfer type label of high adhesion polyester for each work location analyzed, a sample is included in this specification.

B. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:
1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date.

C. Labels shall be machine printed, with no field markings.

D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
1. For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.
4. For each switchgear, one flash label shall be provided.
5. For medium voltage switches one arc flash label shall be provided

E. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

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3.3 ARC FLASH TRAINING

A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 8 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard For Electrical Safety Requirements For Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).



END OF SECTION

SECTION 26 08 10 - ELECTRICAL 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. Testing, evaluation and calibration of equipment provided, installed and connected in Division 26.
   2. Evaluation of connection and normal operation of utilization equipment, provided in other Divisions, for installation and connection in Division 26.

1.3 REFERENCES

A. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by IETA.

B. Applicable Codes, Standards and References:
   1. National Electrical Code (NEC).
   2. National Electrical Manufacturer's Association (NEMA).
   3. American Society for Testing and Materials (ASTM).
   4. Institute of Electrical and Electronic Engineers (IEEE).
   5. International Electrical Testing Association (IETA).
   6. American National Standards Institute (ANSI).
   7. State and local codes and ordinances.
   8. Insulated Power Cable Engineers Association (IPCEA).
   9. Association of Edison Illuminating Companies (AEIC).
   10. OSHA Part 1910; Subpart S, 1910.308.
   11. National Fire Protection Association (NFPA).

1.4 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Retain the services of a recognized independent testing firm for the purpose of performing inspections and tests as specified herein.
   2. Independent test firm providing report direct to Architect.
   3. All material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.

4. It is the intent of these tests to assure that all electrical equipment, Contractor or Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
5. Tests and inspections determine suitability for energization.
6. Supply to the independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplier under Contractor's direction, setting of all adjustable devices and other information requested by testing agency).

B. Scope of Testing, Evaluation and Calibration:
1. Power transformers.
2. Distribution transformers.
3. Low voltage circuit breakers.
4. Switchboards.
5. Ground fault protective signaling.
6. Protective relays and associated instrument transformers.
7. Grounding systems.

1.5 SUBMITTALS

A. Test Reports:
1. Maintain written record of all tests.
2. At completion of project, assemble and certify a final test report. Submit report to Architect prior to final acceptance to include:
   a. Summary of project.
   b. Description of equipment tested.
   c. Visual inspection report.
   d. Description of tests.
   e. Test results.
   f. Conclusions and recommendations.

1.6 QUALITY ASSURANCE

A. Qualifications of Testing Firm:
1. Corporately independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.
2. Independent organization as defined by OSHA Title 29, Part 1936 and IETA.
3. Regularly engaged in the testing of electrical materials, devices, appliances, electrical installations and systems for the purpose of preventing injury to persons or damage to property and other equipment.
4. Engaged in testing practices for minimum of 2 years.
5. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.
6. Submit proof of above qualifications with Bid Documents.

B. Certifications:

1. Comply with OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910 and 1936. Full membership in the IETA constitutes proof of such criteria.
2. Lead, on site, technical person currently certified by IETA in Electrical Power Distribution System Testing.
3. All instruments used by testing firm to evaluate electrical performance meet IETA Specifications for Test Instruments.

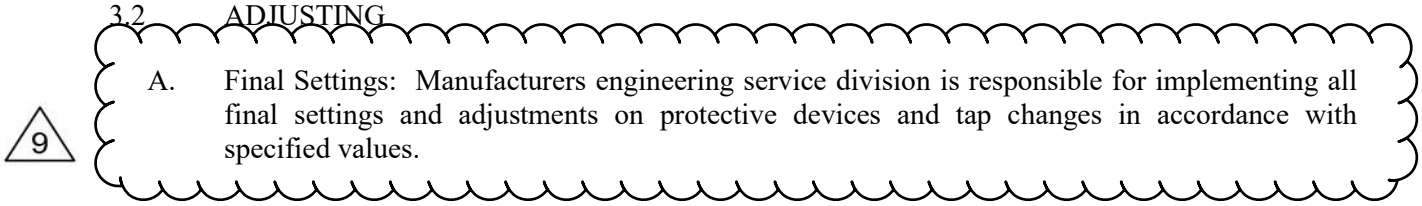
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:
   1. Contractor's Responsibilities:
      a. Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by testing firm.
      b. Notify the testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.
   2. Testing Firm's Responsibilities:
      a. Notify Architect prior to commencement of any testing.
      b. Report directly to Architect any systems, material or installation found defective on the basis of acceptance tests.
      c. Provide auxiliary portable power supply necessary for conducting tests.

3.2 ADJUSTING



A. Final Settings: Manufacturers engineering service division is responsible for implementing all final settings and adjustments on protective devices and tap changes in accordance with specified values.

END OF SECTION

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SECTION 26 24 13 - SERVICE AND DISTRIBUTION SWITCHBOARD

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.
   2. Terms distribution switchboard and distribution panel are used interchangeably on the documents.

1.3 QUALITY ASSURANCE

A. Conform to applicable Codes and NEMA, ANSI and IEEE Standards.

1.4 SUBMITTALS

A. Conform to applicable provisions of Section 01 33 00 of Division 01, Submittals and of 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. One-half inch equal to one-foot scale drawings of electrical rooms or areas overall dimensions for equipment layout including space available for conduits and protective devices.

C. Manufacturer shall provide certification that the equipment supplied under this Section has been reviewed and certified by OSHPD to meet the current criteria for special seismic certification in compliance with 2019 CBC 1708A.4 and OSHPD CAN 2-1708A.4. Include seismic companion anchorage requirements from the testing and as approved by the manufacturer. The manufacturer shall provide an approved label on the equipment enclosure stating that the equipment has been awarded a certificate of compliance for special seismic certification. The label shall include OSHPD special seismic certification pre-approval (OSP) number when relevant.

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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 800 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 solid copper. Bus bars shall be solid copper and 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. Switchboards shall be as manufactured by Eaton or Schneider Electric.

B. Distribution sections shall contain circuit breakers, with shunt trips, ground fault protection, and other accessories, as indicated on the Drawings, as well as provisions for metering. 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.

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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 1/2” 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.

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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. Meters shall be switchboard type semi-flush mounted, with phase selector switches. The height of all devices shall comply with Code and utility company requirements with the switchboard installed on a 2” high concrete pad.

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 Owner.

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 Owner. Provide the Owner with a "Certified Test Report" including test parameters.

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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.

END OF SECTION

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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.

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. Duplex receptacles shall be tamper resistant premium 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.

   4. Wiring device color selection to be provided by Architect. Contractor to verify device color with Architect prior to procurement.

   5. Controlled receptacles; installed per requirements of 2019 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.

6. 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.
7. Isolated Ground Type Duplex Receptacles:
   a. Shall be provided with orange dot or triangle, color to be selected by architect.
   b. Shall be commercial grade and 20 amp 120 volt, UL listed as “Isolated Ground”.
8.
9. 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.

B. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.

C. Weatherproof Receptacles: Shall consist of a listed cast aluminum weather resistant duplex receptacle, mounted in box with a gasketed, weatherproof, cast, while in use cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap.

2.2 SWITCHES AND DIMMERS

A. Toggle 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 plasters 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.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be nylon.

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 are indicated on plans.

G. Install receptacles with the ground down.

H. Install switches with the off position down.

I. Clean debris from outlet boxes.

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J. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.

K. Test each receptacle device for proper polarity.

END OF SECTION

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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. A Certificate of Acceptance will be required to be filed (by the Contractor) 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, SITE LIGHTING.
   4. Section 26 09 43, NETWORK LIGHTING CONTROLS.
   5. Section 26 09 00, CONTROLS AND INSTRUMENTATION.
   6. Section 26 09 23, OCCUPANCY SENSORS.

1.3 REFERENCES

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A. Acceptance Testing Criteria: 2019 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. 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.

B. 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. The lighting acceptance testing shall be included in this letter at the time of equipment submittals.

PART 2 - PRODUCTS

2.1 FORMS

A. Lighting acceptance testing forms and verification procedures for lighting systems that require acceptance testing can be downloaded from the following website: http://www.energy.ca.gov/title24/2013standards/nonres_compliance_forms/

B. These completed forms will be the deliverable product to the enforcement agency and Owner as described in this specification 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 window/skylight masking material required to simulate dark conditions of test during evening hours.
      d. Calibration of equipment such as light meters, photo electric controls, etc.
      e. 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

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SECTION 26 77 00 – ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide assisted listening systems as described herein.

1.2 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

2.1 Assisted Listening Systems

A. Provide and install complete, ADA compliant Assisted Listening Systems as follows:
   1. The campus shall have (as a minimum):
      a. Portable system (Listen LS-88) consisting of a hard suitcase-style carrying case and containing:
         1) (1) LT-84-01 ListenIR Transmitter/Radiator Combo
         2) (2) LR-4200 IR Intelligent DSP IR Receiver
         3) (2) LA-430 Intelligent Ear Phone/Neck Loop Lanyard
         4) (2) LA-401 Universal Ear Speaker
         5) (1) LA-277 Conference Microphone
         6) (1) LA-338 Table Top Tripod
         7) (1) LA-346 Carrying Case
         8) (1) LA-423 4-port USB Charger
      b. The portable systems shall be located in an owner-approve space and be available for check out. Refer to Architectural specifications for signage requirements at conference rooms and assembly areas.

B. The entire system shall be of one manufacturer and shall carry a 2-year (minimum) warranty. The system shall be as manufactured by Listen Technologies or engineer approved equal.

C. For the fixed and portable systems, the quantity of wireless headsets on-site shall satisfy the ADA requirement of 4% of the occupancy in the largest conference room and/or assembly area. Refer to architectural sheets for occupancy loads/types. For each of the fixed ALS systems, the quantity of wireless headsets and neckloops shall also satisfy the ADA requirement of 4% of the occupancy in each classroom where a fixed ALS is installed.

D. In accordance with California Building Code, Assistive Listening Devices shall comply with all requirements set forth in 11B-706.
   1. Receivers required for use with an Assistive Listening System shall include a 1/8-inch (3.2mm) standard mono jack.

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2. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.
3. Assistive listening systems shall be capable of providing a sound pressure level of 110dB minimum and 118dB maximum with a dynamic range on the volume control of 50dB.
4. The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18dB minimum.
5. Peak clipping shall not exceed 18dB of clipping relative to the peaks of speech.

E. In accordance with California Building Code, Assistive Listening Devices shall comply with all signage requirements set forth in 11B-216.10
   1. Each assembly area required to provide assistive listening systems (portable or fixed) shall provide signs informing patrons of the availability of the assistive listening system. The sign shall include wording that states “Assistive-Listening System Available” and shall be posted in a prominent place at or near the assembly area entrance. Assistive listening signs shall comply with California Building Code (CBC) Section 11B-703.5 and shall include the International Symbol of Access for Hearing Loss complying with CBC Section 11B-703.7.2.4.

PART 3 - EXECUTION

3.1 COMMISSIONING

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A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, and servicing of the system. Provide a minimum of 8 hours training. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION

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SECTION 26 91 15 - ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General requirements that apply to implementation of commissioning of electrical equipment.

B. Related work:
   1. 01 91 13 General Commissioning Processes lists Division 26 commissioned systems, and lists other commissioning sections in these Specifications.

1.2 RESPONSIBILITIES

A. Division 26 Contractors: Participate in the Commissioning process as a commissioning team member as described in Section 01 91 13 and in the Commissioning Plan

1.3 SUBMITTALS

A. Division 26 Contractors shall provide submittal documentation relative to commissioning as required in Section 01 30 00 Administrative Requirements.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Refer to Section 01 91 13 Part 2 for Division 21, 22 and 23 requirements.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS REQUIREMENTS

A. Refer to Section 01 91 13 and the Commissioning Plan for information on meetings, functional testing, operations & maintenance data, training requirements, and other commissioning activities.

3.2 TESTING REQUIREMENTS

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A. This section specifies the functional testing requirements for Division 26 systems and equipment. From these requirements, the Commissioning Provider will develop testing procedures in accordance with Section 01 91 13 and the Commissioning Plan. The test procedures for each piece of equipment or system will contain the information below.

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1. Contractors responsible for installation, burn-in, and other testing must be completed with these tasks prior to commissioning testing.
2. Contractor responsibilities for executing functional tests.
3. A list of equipment & components being tested
4. Functions, modes, and testing conditions
5. Required monitoring
6. Acceptance criteria
7. Sampling strategies allowed

END OF SECTION

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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 two (2) 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 6 component and channel compliant.

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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) – 10th Edition, 2003.
   10. National Fire Protection Agency (NFPA – 70), California Electrical Code (CEC) –2019.

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 programs.
9. Provide owner training and documentation. (Testing documentation and As-built drawings).

1.6 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

B. 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.

C. Work shall not proceed without the Owner's approval of the submitted items.

D. 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.

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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 two (2) modular jacks.
   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 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 match the faceplate color used for other utilities in the building or match the color of the raceway if installed in surface raceway.
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 fiber optic couplings to face downward or at a downward angle to prevent contamination and,
   d. 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. Manufacturer: Refer to parts list at the end of this section

D. Cat6 Data Jacks
1. Voice/Data jacks shall be 8-position modular jacks and shall be Category 6 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 6 specifications.
5. The modular jack shall have low emission IDC contacts.
6. The modular jack shall use standard termination practice using 110 impact tool.
7. The modular jack shall be backwards compatible to Category 3, 5, and 5e.
8. The modular jack shall be center tuned to category 6 test specifications.
9. Dust covers shall be used on each termination.
10. Manufacturer: Refer to parts list at the end of this section

E. Cat 6a Data Jacks
1. Data 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. Modular jack color shall match incoming cable plant.
3. The modular jack shall use dual reactance modular contact array.
4. The modular jack shall be both component, link and channel compliant to category specifications in ANSI/TIA/EIA-568-C.
5. The modular jack's performance shall be third-party verified to ANSI/TIA/EIA-568-C Category 6A specifications.
6. The modular jack shall have low emission IDC contacts.
7. The modular jack shall use standard termination practice using 110 impact tool, or manufacturer approved method.
8. The modular jack shall be backwards compatible to Category 3, 5, 5e and 6.
9. The modular jack shall be center tuned to category 6A test specifications.
10. Dust covers shall be used on each termination.
11. Manufacturer: Refer to parts list at the end of this section

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.
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.

C. 110 Cross-Connect System Backboard Channels shall:
1. Be available in 300 and 900 pair sizes.
2. Allow the mounting of 110 100-pair blocks without legs.
3. Include bottom trough and grounding bar.
4. Be wall mountable.

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5. Be of cold roll steel construction.
6. Be manufactured by an ISO 9001 registered company.

D. 110 Wall Mount Vertical Trough shall:
1. Be available in single channel or dual channel configurations.
2. In dual channel configuration shall be used to provide separation for different wiring media.
3. Be available in 300 pair and 900 pair sizes.
4. Be wall mountable.
5. Be used with wall mountable backboard channels. Acceptable configurations include a 300 pair and a 900 pair.
6. Be of cold roll steel construction.
7. Be manufactured by an ISO 9001 registered company.

2.4 MODULAR PATCH PANELS

A. The Modular Patch Panels shall:
1. Meet category 6 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.
5. Use a single piece IDC housing designed to accept larger Category 6 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 and 5e.
13. Be center tuned to category 6 test specifications.
14. Manufacturer: Refer to parts list at the end of this section

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) or an 8 foot version (51 rack units).
l. Be available in standard color of black.
m. Be manufactured by an ISO 9001 registered company.
n. Manufacturer: Refer to parts list at the end of this section

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.

A. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)
1. Physical Characteristics:
   a. The diameter of the insulated conductor shall be 0.044 in. maximum.
   b. Shall consist of (4) twisted pairs.
   c. Shall be suitable for the environment in which they are to be installed.
   d. The color coding of pairs shall be in accordance with T-568B Wiring Scheme:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR

   e. The overall diameter of the cable shall be 0.320” nominal or less.
   f. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
   g. Cable shall withstand a bend radius of 1.3” at -20 degrees Celsius without jacket or insulation cracking.
   h. 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 5.1 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. Cable shall be Berk-Tek LANmark-10G2 UTP, Berk-Tek LANmark XTP (for small-diameter applications) or approved equal.
4. Cable installed underground/below slab in conduit shall be Berk-Tek LANmark series category 6A (wet location) or approved equal.
5. Cable installed in plenum spaces shall be plenum (FT6 flame rating) rated.
6. Color of all CAT6A cable shall be blue.
7. Manufacturer: Refer to parts list at the end of this section
8. Cable installed underground/below slab in conduit shall be OSP (wet location)

B. 100 OHM Category 6A UNSHIELDED TWISTED PAIR CABLE (UTP)

1. Physical Characteristics:
   a. The diameter of the insulated conductor shall be 0.044 in. maximum.
   b. Shall consist of (4) twisted pairs.
   c. Shall be suitable for the environment in which they are to be installed.
   d. The color coding of pairs shall be in accordance with T-568B Wiring Scheme:

Pair 1	Pair 2	Pair 3	Pair 4
W-BL; BL	W-O; O	W-G; G	W-BR; BR

   e. The overall diameter of the cable shall be 0.320” nominal or less.
   f. The ultimate breaking strength measured in accordance with ASTM D 4565 shall be 400 N minimum.
   g. Cable shall withstand a bend radius of 1.3” at -20 degrees Celsius without jacket or insulation cracking.
   h. 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 5.1 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. Manufacturer: Refer to parts list at the end of this section
4. Cable installed underground/below slab in conduit shall be OSP (wet location)
5. Cable installed in plenum spaces shall be plenum (FT6 flame rating) rated.

2.7 FIBER OPTIC CABLE

A. Riser Indoor/Outdoor Optical Fiber Non-Conductive Loose Tube with Laser Enhanced 9/125um 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 performance throughput range of 1-Gigabit through 400-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, 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 OFP 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 yellow 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. Manufacturer: Refer to parts list at the end of this section

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. Refer to parts list at the end of this section

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 6 component specifications in ANSI/TIA/EIA-568-B.2-1
4. 100% factory tested to meet category 6 performance and
5. ETL or any other nationally recognized 3rd party verification
6. Be center tuned to category 6 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 and 5e.
15. Be manufactured by an ISO 9001 registered company.

C. Optical Fiber patch cords shall:
1. Contain two (2) multi-mode optical fibers.
2. Use multi-mode, graded-index fibers with a 62.5 micron core.
3. Be capable of transmission at both 850 nm and 1300 nm wavelengths.
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.

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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).

2.13 PARTS LIST

Manufacturer	Part Number	Description	Color/Finish

Extron	DTP HD DA4 4K 230	HDBaseT signal splitter with (1) HDMI loop-through and (4) HDBaseT out.	Black
Extron	DA2 HD 4K	HDMI spliter behind display. (1) HDMI In (2) HDMI Out	Black
Extron	DTP R HWP 4K 231 D	HDBaseT receive	Black
Extron	XTP DTP 24	Shielded Category cabling compliant with A/V HDBaseT end devices	Black
Cables Plus	LV0249C5101N1	24-Strand AFL I/O OFNR Dry Core Strand AFL Singlemode Fiber 9/125 (G.652D)	Black
Panduit	FRME1U	1RU fiber Splice Enclosure	Black
Corning	SOC-LCU-900-SM	LC to LC Fiber Patch Cable	Blue
Panduit	FRME3	3RU fiber Splice Enclosure	Black
Panduit	FAP6WBUDLCZ	Fiber Adapter Panel loaded with LC Duplex OS2 Fiber Adapters	Blue
Chatsworth	46353-703	19" Two-post Telecommuni-cations rack	Black
Chatsworth	10250-712	12" Wide Cable Runway	Black
Chatsworth	35441-702	2U Horizontal Wire Manager w/cable pass-through ports	Black
Chatsworth	35511-703	6" Vertical Wire Manager - Single Sided	Black
Panduit	CPP24FMWBLY	24 Port 1RU Mini-Com Flush Mount	Black
Panduit	CPP48FMWBLY	48 Port 2RU Mini-Com Flush Mount	Black
General Cable	GenSPEED 6000	Category 6 network cabling	Varies per plan
Panduit	UTPSP*Y	Category Copper Patch Cords	Varies per plan

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General Cable	GenSPEED 10	Category 6A network cabling	Purple
Panduit	CFPL21WY	Data Faceplate	Confirm with Architect
Panduit	CFPL41WY	4-Port Data Faceplate	Confirm with Architect
Panduit	KWP6PY	1-Port Phone plate and module	Confirm with Architect
Panduit	CJ688TG*	CAT6 Keystone Jack	Varies per plan
Panduit	CJ6X88TG*	CAT6A Keystone Jack	Purple
Listen	LS-88	Portable Assistive Listening System	N/A

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. Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

G. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.2 HORIZONTAL DISTRIBUTION CABLE INSTALLATION

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA/EIA-569-A maximum fill for the particular raceway type or 40%.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. 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.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

G. 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.

H. 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.

I. 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.

J. 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.

K. 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.

L. 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.

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M. 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.

N. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

O. 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.

3.3 HORIZONTAL COPPER TERMINATION AND INSTALLATION

A. 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.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. 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.

E. The cable jacket shall be maintained as close as possible (within 25mm – 1 inch) to the termination point.

F. 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.

3.4 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.

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3.5 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.

3.6 RACKS

A. Racks shall be securely attached to the concrete floor using a minimum 3/8” hardware or as required by local codes.

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 9.0 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.

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3.7 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.

3.8 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.

3.9 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.

3.10 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 and 6A 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 6 Performance Shall meet the link requirements outlined below for a 90-meter, 4-connector permanent link.

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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	69.0	64.0	65.3	62.3	21.0
4.0	4.0	67.0	62.5	53.2	50.2	21.0
10.0	6.3	60.6	46.0	45.3	42.3	21.0
20.0	9.0	55.6	51.0	39.2	36.2	21.0
31.25	11.3	52.4	47.7	35.4	32.4	19.1
62.5	16.4	47.4	42.6	29.3	26.3	16.1
100.0	21.2	43.9	39.1	25.3	22.3	14.0
155.0	26.6	40.7	35.8	21.4	18.4	12.1
200.0	31.5	38.8	33.9	19.2	16.2	11.0
250.0	36.0	37.1	32.4	17.3	14.3	10.0

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 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.

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 6 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.

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.

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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

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SECTION 28 55 00 – EMERGENCY RESPONDER RADIO COVERAGE SURVEY

PART 1 – GENERAL

1.1 SUMMARY

A. Specification intent is to establish the requirements and standards for initial survey for public safety radio signal strength per NFPA, IFC and local AHJ requirements.

B. Survey shall be performed after the building is substantially completed, and prior to start of installation of electrical wiring.

C. Contractor shall perform a survey using an RF Spectrum Analyzer, a calibrated, system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of the Emergency Responder Radio Signal into the buildings and determine the amplification of the required signal. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code.

1.2 SURVEY CRITERIA IF REQUIRED

A. The required Public Safety Radio Signal Level inside the Buildings must be determined per code, ordinance or AHJ.

B. Survey shall be performed by an FCC licensed technician holding a current license required by code for this application.

1.3 REGULATIONS

A. Codes, regulations, and standards referenced in the Section are:

1. NFPA 1 – The National Fire Code

2. NFPA 70 – The National Electrical Code

3. CFC 510- Emergency Responder Radio Coverage

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4. NFPA 101, Life Safety Code, the California Building Code, and Local Code and Building Authority requirements.

5. NFPA 72 National Fire Alarm Code

6. FCC 47 CFR Private Land Mobile Radio

7. 90.219 Services-Use of Signal Boosters

8. ICC International Fire Code, Code and Commentary

9. Local or State Promulgated Fire Code

10. ADA "Americans with Disabilities Act"

11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"

12. FCC Rules Part 22, Part 90 and Part 101

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13. NFPA 1221 2019 Edition

14. UL 2524

1.4 DEFINITIONS

A. Definitions:

1. Bi-Directional Amplifier BDA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.

2. Emergency Responder Radio Coverage System: A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.

3. FCC: Federal Communications Commission

4. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

5. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies.

6. RSSI: Received signal strength indicator RSSI is a measurement of the power present in a received radio signal.

7. BER: Bit Error Rate is the number of bit errors per unit time

8. GROL- FCC General Radio Operators License

9. ERRCES- Emergency Responder Radio Coverage Enhancement System

10. DAS-Distributed Antenna System

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1.5 EXECUTION

A. Testing Procedures

1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be based on the. -95dBm nominal signal at 100%.

2. Spectrum Analyzer or Calibrated Handheld Radio shall be used as basis for signal measurements or other method as approved by AHJ.

3. Testing should be based on a minimum of 20 grid locations per floor or maximum of 1600 SQ ft. areas if the floor exceeds 32,000 Sq. Ft. Also, testing should include all areas per NFPA. See NFPA 72 2019 or NFPA 1221 2019, or as required by the local AHJ, local code or ordinance.

4. A minimum signal strength of -95 dBm shall be provided throughout the coverage area for both uplink and downlink by the Local Fire Department.

    a. RSSI measurement only

1.6 SURVEY SUBMITTALS

A. Submit testing data for each level of all buildings.

1. An RF measurement drawing of each floor of all buildings which indicates relative RF field strength for each frequency band of interest must be submitted to the AHJ.

2. Contractor to prepare shop drawing to clearly indicate the areas that have passed or failed based on the above requirements.

END OF SECTION

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SECTION 28 55 10 – EMERGENCY RESPONDER RADIO COVERAGE SYSTEM

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 Emergency Responder Radio Coverage system for the buildings shall be provided based on a performance specification: Provide component and system design (functional block diagram) submittals based on the performance criteria as listed, and as shown on the plans.
   2. System shall comply with requirements of UL2524 In-building 2-Way Emergency Radio Communication systems, NFPA 72, NFPA 1221, and CFC 2019 Section 510.
   3. System shall meet all requirements of local responding agencies, and all authorities having jurisdiction (AHJ).
   4. Contractor shall perform a site survey in accordance with Specification Section 28 55 00 – Emergency Responder Radio Coverage Survey.
   5. Contractor shall prepare engineered plans and specifications and submit to local AHJ and obtain a separate permit / AHJ approval, prior to installation.
   6. All areas with-in all buildings and site enclosures shall be provided with radio coverage to meet AHJ requirements.
   7. An approved manufacturer or qualified and approved vendor shall supply, test and determine locations of components required for proper operation, provide, install, test and certify the performance of the complete system. Vendor qualifications must be acceptable to the AHJ.
   8. Provide and install all antennas, pathways, amplifiers, signal boosters, cabling, connectors, straps, supports, testing, etc., required for a complete full functioning radio coverage system as described herein and on the plans.

1.3 SUBMITTALS

A. Submit in accordance with Section 26 05 00, COMMON WORK RESULTS FOR ELECTRICAL.

PART 2 - PRODUCTS

A. The system design shall be based on the GAMEWELL-FCI line of Public Safety Signal Boosters UL2524, NFPA 72, NFPA 1221, IFC and FCC certified to establish standards of quality for materials and performance.

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B. Design shall include iBwave software-simulated radio propagation modeling with heat maps showing predicted signal coverage levels within the building. The iBWave design shall be done by iBWave certified personnel.

C. Signal booster shall be Class B Public Safety type as designated by FCC or as required by the AHJ.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present for compliance with requirements and other conditions affecting the performance of the system work.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
1. Install system in accordance with NFPA 72 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Wiring Methods:
1. Install all cabling in raceways listed for the application.

C. Impedance and Level Matching:
1. Carefully match input and output impedance’s and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring:
1. Install control circuits in accordance with NFPA 72 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
2. All housings are to be located as specified and shown on drawings.
3. Make installation in strict accordance with approved manufacturer's drawings and instructions.
4. The contractor shall provide necessary transient protection on the AC power feed.

E. Wiring Within Equipment:
1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess.

F. Identification of Conductors and Cables:
1. Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

G. Repairs:

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1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

3.3 GROUNDING

A. Provide equipment grounding connections for systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, and other impairments.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
   2. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified.
   3. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
   4. All tests shall be conducted, documented, and signed by a person in possession of an FCC General Radio Telephone Operators License. All testing personnel shall be certified and authorized by the signal booster manufacturer in the installation and operation of their equipment. Personnel qualifications must be acceptable to the AHJ.

3.5 COMMISSIONING

9

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Provide a minimum of 8 hours in service training. Operators Manuals and Users Guides shall be provided at the time of this training.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION

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SECTION 403.009 EMERGENCY RESPONDER COMMUNICATION ENHANCEMENT SYSTEMS

PURPOSE

The purpose of this policy is to clarify the Fresno Fire Department's (FFD or Department) requirements regarding the installation of all emergency responder communication enhancement (ERCES) systems.

APPLICATION

This policy applies to all ERCES systems within the City of Fresno (COF) and contract service areas.

OPERATIONAL POLICY

Based upon the need for uniformity in application across the Department's diverse service delivery area, and after careful deliberation, the Department has determined the following:

Permit Requirements (Baseline / Preliminary Testing)

1. Prior to baseline / preliminary testing, all person(s) or firm(s) completing testing shall first obtain a test permit from FFD. A test permit is not required if the permit applicant clearly indicates that they will be installing an ERCES system (rather than testing the building for signal strength) on the building plan submittal. This declaration shall be positive and shall not conflict with any other ERCES notes regarding a deferred submittal.

Required Test Permit Application Documents (Baseline / Preliminary Testing)

1. Copy of the current COF Business Tax Certificate for the testing firm.

2. Copy of the current Federal Communications Commission (FCC) license for the person(s) completing the test.

3. Copy of the formal testing procedures to be used. Formal testing procedures shall comply with the criteria noted in California Fire Code (CFC) §510.5.4, COF Communications Division policies, and shall not include algorithmic or extrapolated results.

4. Detailed information which shows the test instruments' conformance with either Underwriters Laboratory (UL), FCC or other equipment listing agency requirements and last date of test instrument calibration.

Permit Requirement (New Installations)

1. ERCES systems are required to be installed in an approved location. Where required to be installed per the *CFC*, or the *Fresno Municipal Code (FMC)*, permits for installation must be obtained from FFD prior to the commencement of work.

Testing Requirements

1. Prior to any ERCES testing, the permit applicant/testing contractor shall notify the Department to ensure the test is in conformance with the Department's required testing items, including every FFD required "critical point" – See "Definitions" below.

2. Automatic pass / fail criteria:

   The minimum inbound and outbound signal strength shall be -95 dBm or stronger, as well as have a signal-to-noise and distortion ratio (SINAD) of 20 or greater (≥ 20) throughout the coverage area.

   The building shall be considered to have acceptable in-building, two way emergency responder communication system coverage where signal strength measurement in 95% of all areas and 99% of areas designated as critical areas by the fire code official on each floor of the building meet the signal strength requirement.

Planning and Construction Requirements

1. It is the obligation of the property owner (and agents of the owner as necessary) to plan for the installation of an ERCES. ERCES systems are required as noted in the CFC and FMC.

2. If an owner or permit applicant chooses to complete ERCES testing (which must be completed as a building is substantially complete – including equipment installation) as permitted in the FMC, in lieu of the required ERCES installation, any resultant delays in obtaining a certificate of occupancy which are caused by the failure of the property owner to plan for and coordinate required ERCES testing and installation will result in delays in obtaining a certificate of occupancy.

3. As the permitting authority, a sworn FFD staff member, will determine which frequencies are to be amplified, etc. These frequencies may include those at the local, state, federal or tribal level, and will be determined after a formal application has been submitted for review and approval. No other department, division, agency or person has the authority to make this determination.

Plan Submittal Documents

1. ERCES system documents must be drawn with due care by a trained person meeting all the requirements found within the applicable laws, codes, ordinances, standards, and this policy.

2. Plans must be drawn on a minimum of twenty-four (24") inch by thirty-six (36") inch paper and must be drawn to an indicated scale of not less than one-eighth (1/8") inch = one (1') foot.

3. All notes and information on each plan sheet will be a minimum of twelve (12) pt. font or larger. Fonts will be Engineers font, Architects font, Arial font or Calibri font. Plans using unusual or difficult to read fonts will not be accepted. The Fire Marshal, or designee will make the determination of acceptability, and the determination will be final.

4. An area of no less than four (4") inches by six (6") inches, located in the bottom right-hand corner of each plan sheet (excluding the title block), must be left free of any text, mark, etc., to facilitate the marking of plans by Department staff.

5. Drawings must be organized (generally) based upon the *United States Department of Energy, Fundamentals Handbook for Engineering Symbology, Prints, and Drawings* (Vols. 1 & 2) (1993 edition). Available for download at: http://edtech2.boisestate.edu/jasonclemens/512/files/DOE-v1.pdf

6. Drawing line weights, matchlines (where used) and legibility (including printed pages) must be in accordance with either the *United States Department of Energy, Fundamentals Handbook for Engineering Symbology, Prints, and Drawings* (Vols. 1 & 2) (1993 edition), or the latest edition of the American Institute of Architects design guidelines.

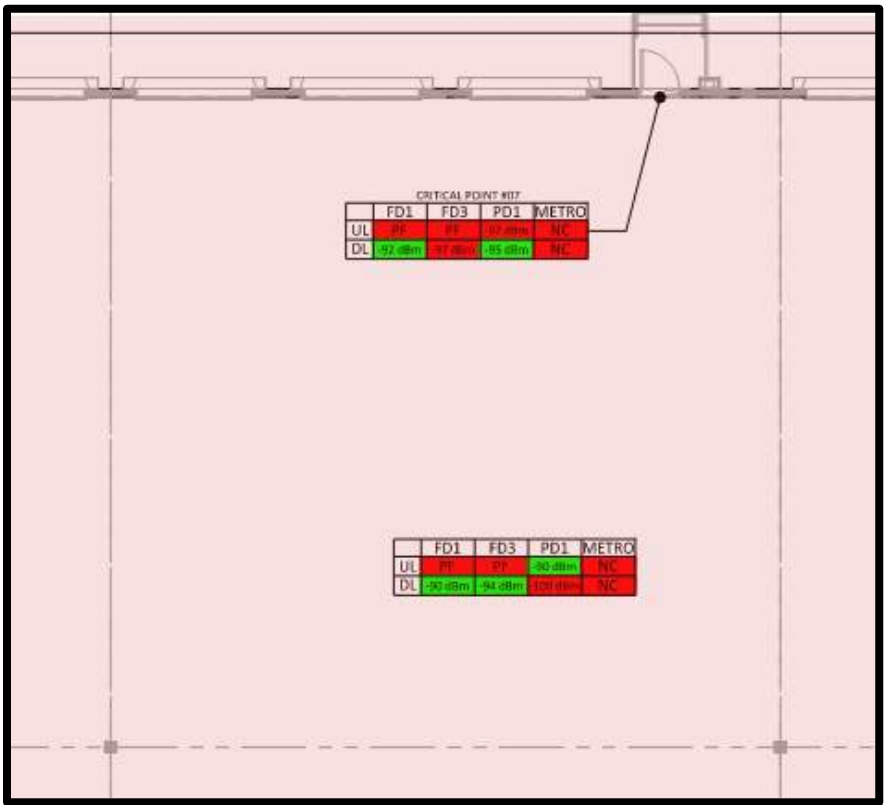
7. All electrical plan symbols must be in accordance with *National Electrical Contractors Association (NECA) 100 Symbols for Electrical Construction Drawings (ANSI) (2013 edition)*, where a symbol is provided. Other symbols are not permitted by FFD.

8. All fire protection symbols must be in accordance with *National Fire Protection Association (NFPA) 170* – Standard for Fire Safety and Emergency Symbols (2018 ed.) where a symbol is provided. Other symbols are not permitted by FFD. Initiating and activation devices shall be shown as required in Table 8.3 and notification appliances shall be shown as required in Table 8.4.2.

9. The use of “heat maps” to indicate signal strengths is not permitted.

   Designers shall provide clear delineation lines for each tested grid, then indicate the tested signal strength, and provide numeric coverage indications to show the signal strength and if the tested strength is compliant or not using only “Pass/Fail” language.

   An example of the proper way to show pass/fail for a grid is noted below:



10. Each of the following items must be included on submitted plans. Plans will be returned for revision when the following items are not present:

    a. A detailed scope of work for the project including a description sufficient to clearly indicate the location, nature, and extent of the work. A scope of work indicating “installation of an ERCES system” or similar non-descript scoping is inadequate for the purposes of compliance with this policy.

    b. Location of the project, including the COF officially assigned address.

    c. A site plan of the location. The required site plan (including north arrow) shall be scaled or dimensioned and show the subject building and surrounding property. A location pin from mapping software does not meet this requirement.

    d. The site plan shall also include a table showing the following information: Equipment Room ID, Outdoor antenna model number and type, Antenna gain, Azimuth, and distance to the donor site.

    e. The site plan must indicate the location of the building’s Knox box. Buildings equipped with an ERCES system must have a Knox box installed in an approved location. The Knox box shall have a sign located directly adjacent to the Knox box stating: “ERCES”. Signage shall be in conformance with FFD Policy #402.016

    f. Name of the permit applicant, installing contractor, address, phone number, type of license and license number, with wet stamp and signature on each plan sheet.

    g. *The California Building Code* (CBC) occupancy group of the building and an indication of whether the building is equipped with a fire sprinkler system.

    h. Equipment legend. Equipment legends must be prepared in the format shown on the sample legend at the end of this policy. All equipment must be shown including Conduit, Cabling, Cable ties, Attachment equipment, Signage, etc.

    i. The total square footage of the building.

    j. A complete interior floor plan of the building including all critical areas.

k. A roof detail which shows whether the roof is of combustible construction. Where the building is constructed with a combustible roof, all interior cabling shall be enclosed in rigid, metallic conduit. Where interior cabling is run in combustible concealed spaces (i.e., floor / ceiling assemblies, etc.) the cabling shall be run in rigid, metallic conduit.

l. ERCES equipment rooms shall be constructed of a minimum of 1 hr. fire resistant rated construction. No exceptions.

m. Applicable details of the ERCES equipment room, including the room dimensions which clearly indicate the required three foot (3') clear working space has been provided in front of and adjacent to all ERCES equipment. Room finished ceiling height, etc.

NOTE: ERCES system components that are installed in any area, including fire pump rooms, must not interfere with the FFD required three foot (3') clear working space for all fire protection system equipment. It is the obligation of the permit applicant/designing and installing contractor to coordinate the installation and maintain the required clear working space in front of and adjacent to all fire protection equipment. Installations of ERCES equipment which interferes with clear working space requirements will be required to be relocated. No exceptions.

n. Approved permanent and durable signage affixed to all doors containing ERCES equipment. Required signage shall include a sign noting: "ERCES" which conforms to FFD policy #402.016, and a sign as shown below.

The sign shall have the exact text, exact color, and exact symbol. The sign shall be at least 7" in height and 5" in width.



Because this signage is likely to be installed on fire resistance rated door assemblies, it is incumbent on the installer to ensure that proper mounting does not inadvertently reduce the doors rating.

o. A radio coverage grid diagram, with a minimum of twenty (20) grids per floor, no grid shall be larger than eighty feet by eighty feet (80’ X 80’).

p. Partial ERCES systems are not permitted. Any system which is required to be installed shall be provided throughout the entire building. No exceptions.

q. All new buildings required to have an ERCES system installed in buildings that are fully protected by an automatic sprinkler system in accordance with the CFC, NFPA 13, and the FMC may have unrated cables and cable components installed, except as noted below.

r. All new buildings required to have an ERCES system installed shall have cabling run in not less than a two-inch (2”) rigid, metallic conduit installed between the ground floor (or the bottom subterranean floor as applicable) and the roof.

s. Construction documents shall include installation details for the cable between the amplifier and the antennas on each floor. Cabling that is run in open air, shall have a minimum 1-hr. fire resistance rating. Unrated cabling between the amplifier and antennas on each floor shall be run in rigid, metallic conduit – no exceptions. All cabling shall be located below fire sprinkler deflectors. General notes or descriptions are not sufficient to meet this requirement.

t. Elevation and roof plans must be provided indicating the location, orientation, and height above roof level of donor antenna mounts, method of mounting, and the location of cable routes and entries to the roof or wall below. The designer shall include detailed diagrams indicating grounding, surge protection, anchoring and cable entries in compliance with the *California Electrical Code* (CEC). General/generic notes or descriptions are not sufficient to meet this requirement.

u. Antennas and their supporting appurtenances shall not be mounted to the sides of buildings, unless specifically approved by the Fire Marshal (or designee).

v. A grounding and lightning protection diagram and details showing the antenna mount, cable, cabinet, and electrical ground connections to the building ground system shall be provided.

w. Construction details and a note which clearly states the pathway survivability level for the system using the NFPA 72 survivability criteria. Designer shall note on plans if the system meets NFPA level 1, 2 or 3 for survivability for each of the cable extensions to the indoor mounted antennas.

x. Construction details indicating how the ERCES system is connected to the building fire alarm system including a description and sequence/matrix of events associated with testing the alarms shall be provided. The sequence/matrix shall be prepared as noted in NFPA 72 §A.14.6.2.4.

y. Include a schematic drawing of fire alarm interconnection including address points, etc. General notes or descriptions are not sufficient to meet this requirement.

z. Construction details and notes showing physical installation of equipment and panels, climate control system, fire protection features, security features shall be provided. Indicate on plans how signal booster components and battery systems are mounted in NEMA 4-type waterproof cabinets. General notes are not sufficient to meet this requirement.

aa. The required, rigid metallic conduit shall extend from the ERCES equipment room to the center of the building, then extend upwards to the center of the building's roof.

bb. Construction details indicating how the cable is protected against physical damage in areas that have public access and on roof tops. General notes are not sufficient to demonstrate compliance.

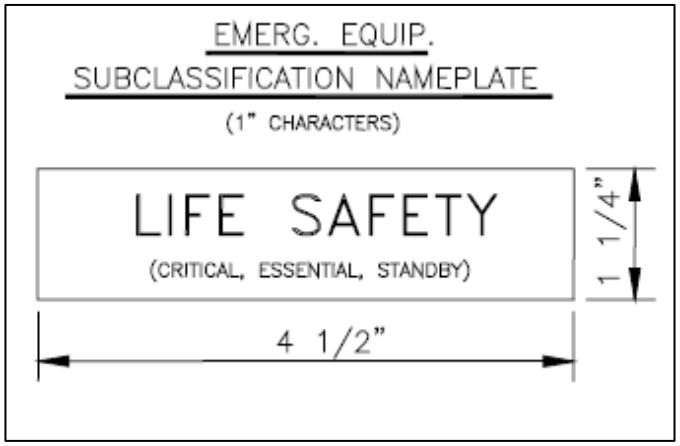
cc. On each floor and the building roof, a CBC and CEC compliant opening shall be made to allow unencumbered access to the conduit from the ceiling or roof.

dd. Penetrations in any fire resistance rated assemblies shall be protected as required in the CBC/CEC and shall be a one-hour (1 hr.) fire resistive rating minimum.

ee. All floors in subterranean parking garages are required to have a similar conduit installation.

ff. No other cabling is permitted to comingle with the ERCES system cable in the conduit.

gg. Conduit containing ERCES cabling shall be marked/labeled with a red label with white lettering which reads “ERCES” or “EM – CR” (Emergency Critical). The size of the labeling shall be as noted in the diagram below:



hh. Every marking/label shall also comply with ANSI/ASME A13.1-2023 ed. requirements for UV resistance, environmental durability, and adhesion requirements.

ii. ERCES conduit in a room shall have at least one label placed on the conduit in a given room. When the conduit exceeds 4’ in length labeling shall be placed at intervals of no less than 10’.

jj. The designer shall note the branch circuit means supplying the ERCES, and circuit shall be permanently identified at the control unit.

kk. All ERCES circuit disconnecting means must have an approved (prominent) marking at the circuit and a lock off/out clip.

ll. ERCES systems must be provided with at least two (2) independent and reliable power supply sources conforming to the requirements of the currently adopted edition of NFPA 72 and the CEC. One source shall be designated as the primary and one shall be designated as the secondary.

mm. The standby power supply shall be an approved UPS system or backup batteries capable of operating the emergency responder radio coverage system for a duration of not less than twenty-four (24) hours. When primary power is lost, the power supply to the emergency responder radio coverage system shall automatically transfer to the standby power supply. The ERCES or UPS system shall be equipped with an emergency power off (EPO) switch.

nn. The ERCES or UPS system EPO switch shall be listed, indicating, of an approved size and type, and shall be placed in an approved position. The EPO switch must also be labeled in accordance with FFD policy #402.016.

oo. An equipment list shall be provided. The list shall include the following information: Manufacturer part number, description, quantity, and symbol to be used on plans. Include a table showing FCC-issued certification numbers for all electronic equipment. NFPA 1225 §18.12.1.

At a minimum, the equipment list shall include the following:

- Amplifiers
- Antennas & mounts
- Coaxial cables
- Connectors
- Splitters
- Combiners
- Couplers and any other passive components proposed
- NEMA 4-type waterproof enclosure for repeaters, transmitters, receivers, signal booster components and battery system components.
- Any equipment requiring FCC certification.
- Backup battery/UPS and charging system or if used, generator including City of Fresno approved plans and specifications.

13. The following standard notes must be applied to the first sheet of plans:

    a. It is the permit applicant's/installing contractor's responsibility to make all work available for inspection.

    b. A full-sized, complete, copy of the approved plan set (incl. manufactures. equipment) is required to be on-site during any fire department inspection.

    c. Installation must comply with CEC §300.21, Spread of Fire or Products of Combustion, regarding penetrations through fire-resistive assemblies to prevent the spread of fire and toxic products of combustion.

    d. Exterior components are required to be mounted in a weather-tight manner.

    e. All existing equipment is required to be noted with an (E) on all submittal documents (if applicable).

    f. The designer has verified all equipment to be installed is compatible with existing equipment (if applicable).

    g. All applicable code references must be provided (i.e., NFPA 72, 1225, etc.).

14. Each ERCES plan submittal must be accompanied by a submittal booklet which includes the following information:

    a. The submittal book cover sheet must include the CBC occupancy classification, official COF address and note that it is for an ERCES system.

    b. The submittal book must include an equipment legend that identifies all equipment on an eight and one-half inch by eleven-inch (8 ½" X 11") sheet. The following information must be in the legend: Equipment manufacturer name, model #, plan symbol, and quantity to be installed as required. This should be a separate page in the submittal booklet.

    c. Provide the laboratory listing sheets (UL 2524), for all equipment that is to be installed.

d. Manufacturer's information sheets each type and piece of equipment to be installed, this includes conduit, hangers, fasteners, etc.

NOTE: It is the permit applicant's/designer's responsibility to provide completed, comprehensive booklets, not loose sheets. Loose sheets will not be accepted. No exceptions.

OPERATIONAL GUIDELINE

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PROCESS

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INFORMATION

As noted in the CFC, the fire code official has the authority to formulate policies they deem necessary based upon local conditions related to plan submittals for all systems and applications. Additionally, as noted in the FMC, ERCES systems shall comply with the CFC, NFPA 1225, Standard for Emergency Services Communications, and FFD policy.

The requirements noted in this policy apply to both required and voluntary systems.

DEFINITIONS

1. Critical Areas: Critical areas for the purposes of this policy are defined as a six-foot (6') radius circle in front of all fire protection features, on every floor, including, but not limited to:

   Every required high-piled storage access door, every elevator hoistway door, every enclosed interior stair door, all interior fire sprinkler system control valves, all hose valves, fire alarm control units and remote annunciators, fire pumps and their associated appurtenances including controllers, etc., all emergency responder communications enhancement system equipment, etc.

CROSS-REFERENCES

Fire Prevention Manual
Section 402.016, Fire Department Required Signage

California Fire Code, currently adopted edition

California Building Code, currently adopted edition

California Electrical Code, currently adopted edition

Fresno Municipal Code

NECA 100, Symbols for Electrical Construction Drawings (ANSI) (2013 edition)

National Fire Protection Association (NFPA), currently adopted editions
NFPA 170, Standard for Fire Safety and Emergency Symbols
NFPA 1225, Standard for Emergency Services Communications

UL 2524, Standard for In-Building 2-Way Emergency Radio Communication Enhancement Systems.

United States Department of Energy, Fundamentals Handbook for Engineering Symbology, Prints, and Drawings (Vols. 1 & 2) (1993 edition)

SAMPLE EQUIPMENT LEGEND

E.R.R.C.S. SYMBOL LEGEND

QTY.	SYMBOL	PART NUMBER	DESCRIPTION	FCC ID #	MANUFACTURER
001		BDA-YDA450470-9-1	YAGI DIRECTIONAL ANTENNA 450-470MHz, N FEMALE	N/A	HONEYWELL
002		BDA-YDA150160-7-1	DONOR ANTENNA, YAGI DIRECTIONAL 150-160MHZ 7 dBi	N/A	HONEYWELL
001	M	BDA-ANT-MONKIT-001	UPLINK VHF ANTENNA MONITORING KIT (UHF & DOWNLINK VHF SELF-MONITOR VIA BDA)	N/A	HONEYWELL
009		BDA-OIA-1301000-2	DOWN-LINK OMNI INDOOR 130-1000MHz 2dBi	N/A	HONEYWELL
010		BDA-FA-150175-2-1	UP-LINK OMNI INDOOR 150-175 MHz	N/A	HONEYWELL
001	COMBI	BDA-DBC-12	DUAL BAND COMBINER	N/A	HONEYWELL
001	ATT#	BDA-NATTEN-0505	RF COAXIAL FIXED ATTENUATOR DC - 3000 MHz	N/A	HONEYWELL
005	6dB	BDA-DC6-L2	DIRECTIONAL COUPLERS, 6 dB COUPLING, 136 - 870 MHz	N/A	HONEYWELL
005	10dB	BDA-DC10-L2	DIRECTIONAL COUPLERS, 10 dB COUPLING, 136 - 870 MHz	N/A	HONEYWELL
001	15dB	BDA-DC15-L2	DIRECTIONAL COUPLERS, 15 dB COUPLING, 136 - 870 MHz	N/A	HONEYWELL
002	20dB	BDA-DC20-L2	DIRECTIONAL COUPLERS, 20 dB COUPLING, 136 - 870 MHz	N/A	HONEYWELL
002		BDA-PS2-L2	2-WAY POWER SPLITTERS, 136-870 MHz	N/A	HONEYWELL
003	SPD	BDA-PSAX09-6G-N/FF	COAXIAL RF SURGE PROTECTOR, DC - 6GHz, 90W, IP67, 60V MAX	N/A	HONEYWELL
001	ERRC	HONBDA-EA-AVU-ND20	VHF + UHF 136-174MHz + 450-512MHz SIGNAL BOOSTER, 0.5W/+27dBm IN VHF, 1W/+30dBm IN UHF WITHIN NEMA 4X ENCLOSURE	P3TDH14-1A	HONEYWELL
001	BB	HONBDA-BTTY-100100	BBU, 100AH, 24VDC WITHIN NEMA 4X ENCLOSURE	N/A	HONEYWELL

NOTE: ALL SIGNAGE SHALL BE PROVIDED BY GENERAL CONTRACTOR. SEE SHEET NOTE 2 ON SHEET ERRC0.1 AND SHEET NOTE 3 ON SHEETS ERRC1.1C & ERRC1.1M, PERTAINING TO SIGNAGE REQUIREMENTS.

E.R.R.C. SYSTEM CABLE LEGEND*

PART NUMBER	DESCRIPTION	USE	MANUFACTURER
ICA12-50JPLLR	1/2" ALUMINUM PLENUM RATED LOW-LOSS DIELETRIC COAX	ANTENNAS	HONEYWELL

*ALL CABLE SHALL SHOWN SHALL BE ICA12-JPLLR COAX, EXCEPT FOR THE MASTER-TO-REMOTE BOOSTER INTERCONNECTING FIBER OPTIC CABLE