

## APPENDIX

## APPENDIX A

### REPORT FOR GEOTECHNICAL INVESTIGATION





## **REPORT OF GEOTECHNICAL INVESTIGATION**

**Proposed El Dorado Park Improvements**

**44501 5<sup>th</sup> Street East**

**City of Lancaster, California**

***Prepared For:***

**IDS Group, Inc.**

**1 Peters Canyon Road, Suite 130**

**Irvine, California 92606**

**Project No. 7111.23**

**April 17, 2023**



April 17, 2023  
Project No. 7111.23

**IDS Group, Inc.**  
1 Peters Canyon Road, Suite 130  
Irvine, California 92606

Attn.: Mr. Adrian Anderson

Subject: **Report of Geotechnical Investigation**  
Proposed El Dorado Park Improvements  
44501 5<sup>th</sup> Street East  
City of Lancaster, California

Gentlemen:

Presented herewith is the Report of Geotechnical Investigation (the Soils Report) prepared by Associated Soils Engineering, Inc. (ASE) for the proposed new El Dorado Park improvements (the Park Improvements) at the subject property, located at 44501 5<sup>th</sup> Street East, in the City of Lancaster, California (the Site). The work was conducted in accordance with our proposal P23-031 dated February 15, 2023, which received your subsequent authorization.

The geotechnical investigation was planned and performed based on information provided by your office. Provided information included a Concept Plan prepared by RHA Landscape Architect & Planning dated July 6, 2021.

The purpose of this study was to evaluate the subsurface soils conditions at the Site, followed by assessment of site geologic/seismic hazards, performance of engineering analyses and formulation/assembly of recommendations for the geotechnical design and construction pertinent to the Park Improvements. ASE's study has concluded that construction of the Park Improvements is geotechnically feasible provided that the recommendations and design guidelines with respect to ground preparation and foundation construction presented in the Soils Report are incorporated in the project plans and design, and implemented during construction. This Soils Report also presents 1) the findings of the geotechnical field investigation, 2) the summary of potential geological/seismic hazard assessment, and 3) the results of laboratory tests performed.

We at ASE appreciate the opportunity to provide our professional services on this important project and look forward to assisting you during site grading and Park Improvements construction.

If you have any questions or require additional information, please contact the undersigned.

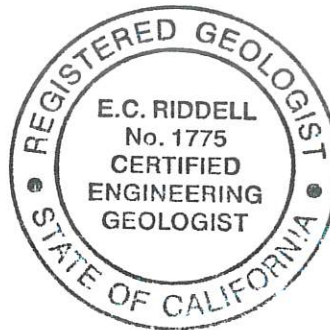
Respectfully submitted,  
**ASSOCIATED SOILS ENGINEERING, INC.**



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## **1.0 INTRODUCTION**

This Soils Report presents the results of ASE's geotechnical investigation for the proposed new Eldorado Park Improvements (the Park Improvements) located predominantly in the southeastern portion of the park site at 44501 5<sup>th</sup> Street East, in the City of Lancaster, California (the Site). The approximate location of the Site is shown on Figure 1, Site Location Map. The purpose of this investigation was to evaluate the general subsurface soil conditions at the Site and provide geotechnical recommendations for the design and construction of the Parking Lot/Improvements. This Soils Report presents the summary of the data collected, the results of ASE's engineering evaluations/analyses, and the pertinent geotechnical conclusions and recommendations.

### **1.1 Project Outline**

The following project information is understood to be applicable at the time of this Soils Report preparation.

#### **1.1.1 Development Scope:**

Based on the provided information, ASE understands that the Park Improvements will consist a new community center building; new picnic areas with tables, shelters and shade structures; new play areas with play equipment; basketball court, skate area, splash pad and other paved areas; paving and hardscape along with landscaped areas throughout the park; appurtenant construction possibly consisting of walls, fencing and light poles.

#### **1.1.2 Structural Loading for Geotechnical Analyses:**

For geotechnical evaluation purposes, ASE has assumed that any planned structures/walls will be supported by isolated pad footings with maximum concentrated column load (D+L) on the order of 10 kips, and by continuous spread footings with maximum line load (D+L) of approximately 2,000 pounds per linear foot. Tolerable total and differential settlements on the order of one (1) inch and 1/4 inch over a 30-foot distance, respectively, have also been assumed by ASE.

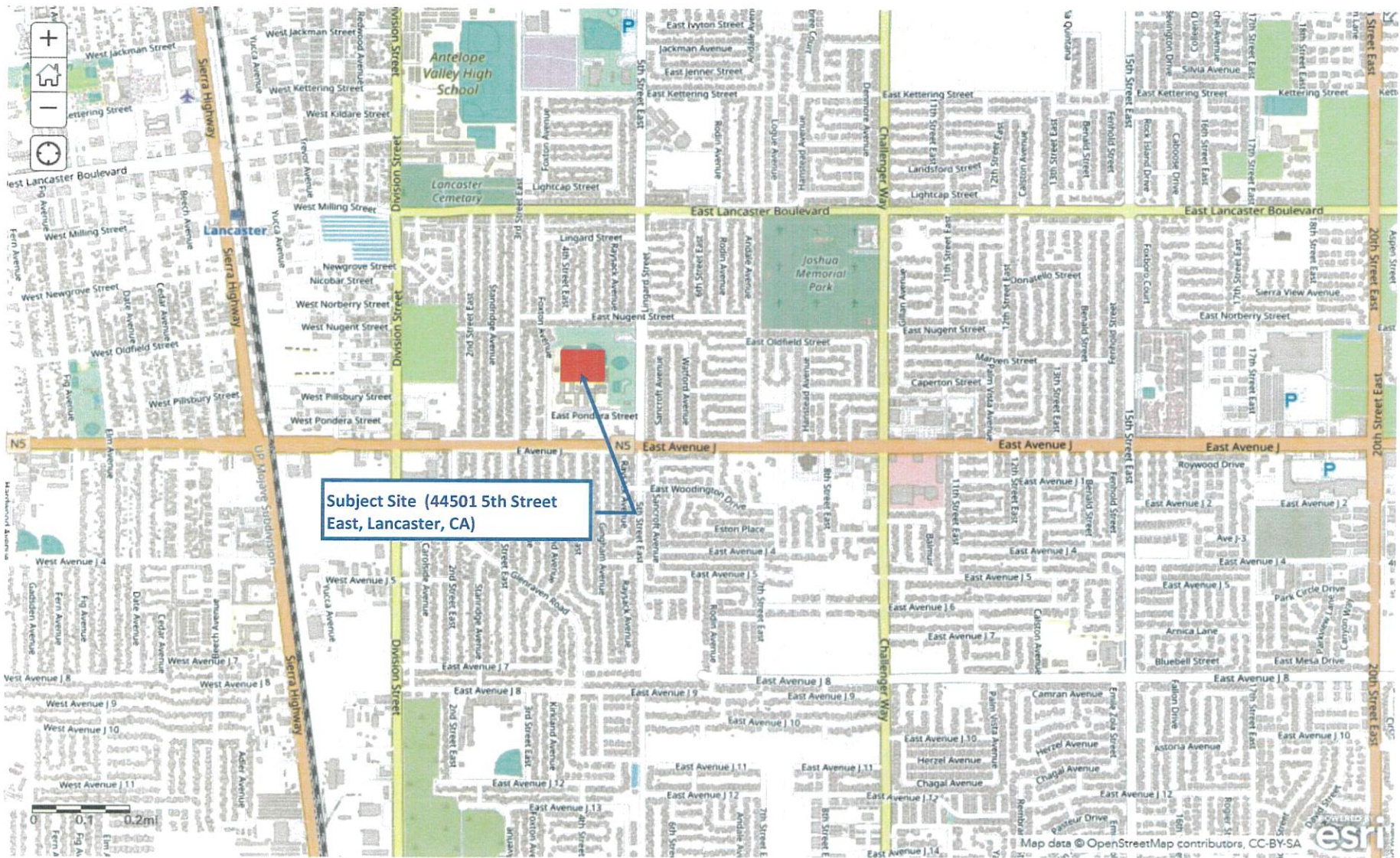
For geotechnical evaluation purposes, ASE assumed that the light poles/shade structures could be supported by Cast-in-Drilled-Hole (CIDH) short piers, with a maximum concentrated column load (D + L) on the order of 10 kips. Tolerable total and differential settlements of footings/piers resulted from the aforementioned structural loadings will be similar to the above-mentioned values.

### **1.2 Scope of Exploration**

In accomplishing the subject investigation, ASE's staff had performed the following geotechnical tasks:

- A. Review of readily available background information, including in-house geotechnical data,





Subject Site (44501 5th Street East, Lancaster, CA)



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## Site Location Map

Proj. Name:

**Proposed Park Improvements  
44501 5th Street East, Lancaster, CA**

**Figure 1**

Proj. No.:

**7111.23**

Date:

**April, 2023**



geotechnical literature, geologic maps, seismic hazard maps, and literature relevant to the Site.

- B. A geotechnical site reconnaissance to observe the general surficial soil conditions at the Site and to select and mark boring locations, followed by 72-hour advance notification to Underground Service Alert of the planned site exploration activities.
- C. Field investigation consisting of drilling seven (7) exploratory borings to depths ranging from 5 feet to 26 feet deep from respective existing grades. ASE's staff logged and sampled representative soils encountered in the exploratory borings. The approximate locations of the exploratory borings on site are shown on the Boring Location Plan, Plate A, in Appendix A.
- D. Field percolation testing at three (3) pre-selected test locations (Borings B-P1, B-P2 and B-P3) to measure infiltration rates of site soils required for the planning and design of stormwater LID system.
- E. Laboratory testing on retrieved representative soil samples for classification and for determination of pertinent engineering properties.
- F. Engineering analyses of data obtained from literature review, the site and laboratory testing covering the following aspects:
  - Evaluation of general subsurface conditions and description of types, distribution, and engineering characteristics of subsurface materials.
  - Determination of the seismic design parameters in accordance with Chapters 16 and 18 of the California Building Code, 2022 Edition (2022 CBC).
  - Evaluation of suitability of on-site soils for foundation support and establishment of qualification criteria of fill material, covering both on-site and imported soils.
  - Recommendations for site remedial grading and subgrade preparation for the Parking Lot/Improvement construction.
  - Recommendations for: design of shallow conventional footing foundations, including allowable bearing capacity, estimated settlement, and lateral resistance, and for slab-on-grade, covering design criteria and construction guidelines.
  - Recommendations for design of CIDH piers for support of any new light poles/signage poles/solar panels, including allowable soils bearing capacity, lateral resistance, and potential settlement.
  - Recommendations for AC and Portland Cement Concrete (PCC) pavements.
  - Evaluation of the corrosion and expansion potential of the on-site materials.
  - Measurement and calculation of design field infiltration rate of site soils for stormwater LID facility planning and design.

- F. Preparation of this Soils Report presenting the work performed and data acquired, as well as summarizing our conclusions and geotechnical recommendations for various aspects of design and construction with regard to the Park Improvements. The calculated design infiltration rate of site soils is also presented in the Soils Report.

Please note that ASE's geotechnical investigation did not include any evaluation or assessment of hazardous or toxic materials which may or may not exist on or beneath the site. ASE does not consult in the field of potential site contamination/mitigation.

## **2.0 SITE AND SUBSURFACE CONDITIONS**

### **2.1 Location, Boundary Conditions and Existing Development**

The proposed new Park Improvements are to be located on the southeastern portion of Eldorado Park at 44501 5<sup>th</sup> Street East, in the City of Lancaster, California. The Site is currently an existing park parcel, with the exception of recently constructed elevated solar panels, that is approximately 1 to 2 feet lower than the improved portion of the Coroner's facility to the east. The site surface is generally uniform and level, with a scattered growth of wild grasses and weeds. The Site is utilized for some overflow parking/storage, with access from an AC ramp at the northeasterly corner of the parcel.

The Site is bound to the north by an AC paved parking lot for the U.S. Postal Service. The Riverside County Coroner facility is east of the Site, with South Redlands Avenue beyond. An undeveloped property is west of the Site. Another undeveloped property utilized for random storage is south of the Site.

### **2.2 Subsurface Conditions**

#### **2.2.1 Artificial Fill (af):**

Artificial fill was not observed in any of ASE's exploratory borings but may be present at other areas of the Site, or could be encountered during site grading, subject to the observation and confirmation of the Geotechnical Consultant.

#### **2.2.2 Younger Alluvial Fan Deposits (Qyf<sub>a</sub>):**

Native site soils consisting of Holocene alluvial-fan deposits were encountered in ASE's exploratory borings to the maximum explored depth of 36 feet. Per Reference 18, the young alluvial fan deposits are associated with deposition from the Amargosa Creek, Little Rock Creek and Creosote Canyon drainages. Soils within the unit are characterized as deposits comprising mainly of fine to medium grained sand with fine to coarse gravel. In specific, the alluvial-fan deposits encountered on site consist of silty sands, sandy silts and fine to coarse grained sands, and are generally in a

damp to moist condition. Figure 2, Local Geologic Map, excerpted from Reference 18, shows geologic material distribution in the vicinity of the Site.

More detailed descriptions of soils encountered and conditions observed during the subsurface exploration are shown in the Field Logs of Borings ("B" Plates), in Appendix A, together with information including soil classifications, depths and types of soil samples, blow counts, field dry densities and moisture contents, and corresponding laboratory tests performed.

### **2.3     Groundwater and Caving**

During field exploration, groundwater was not encountered to the maximum explored depth of 36 feet in Boring B-1. A search on Google Earth indicates that Site grade is approximately 2395 to 2399 feet above Mean Sea Level (MSL).

Information from Information available from the State of California Department of Water Resources website ([www.water.ca.gov/waterdatalibrary/groundwater/hydrographs](http://www.water.ca.gov/waterdatalibrary/groundwater/hydrographs)) indicates that the groundwater elevation in wells within ½ mile of the site exhibit depths to ground water of greater than 100 feet below ground surface (bgs).

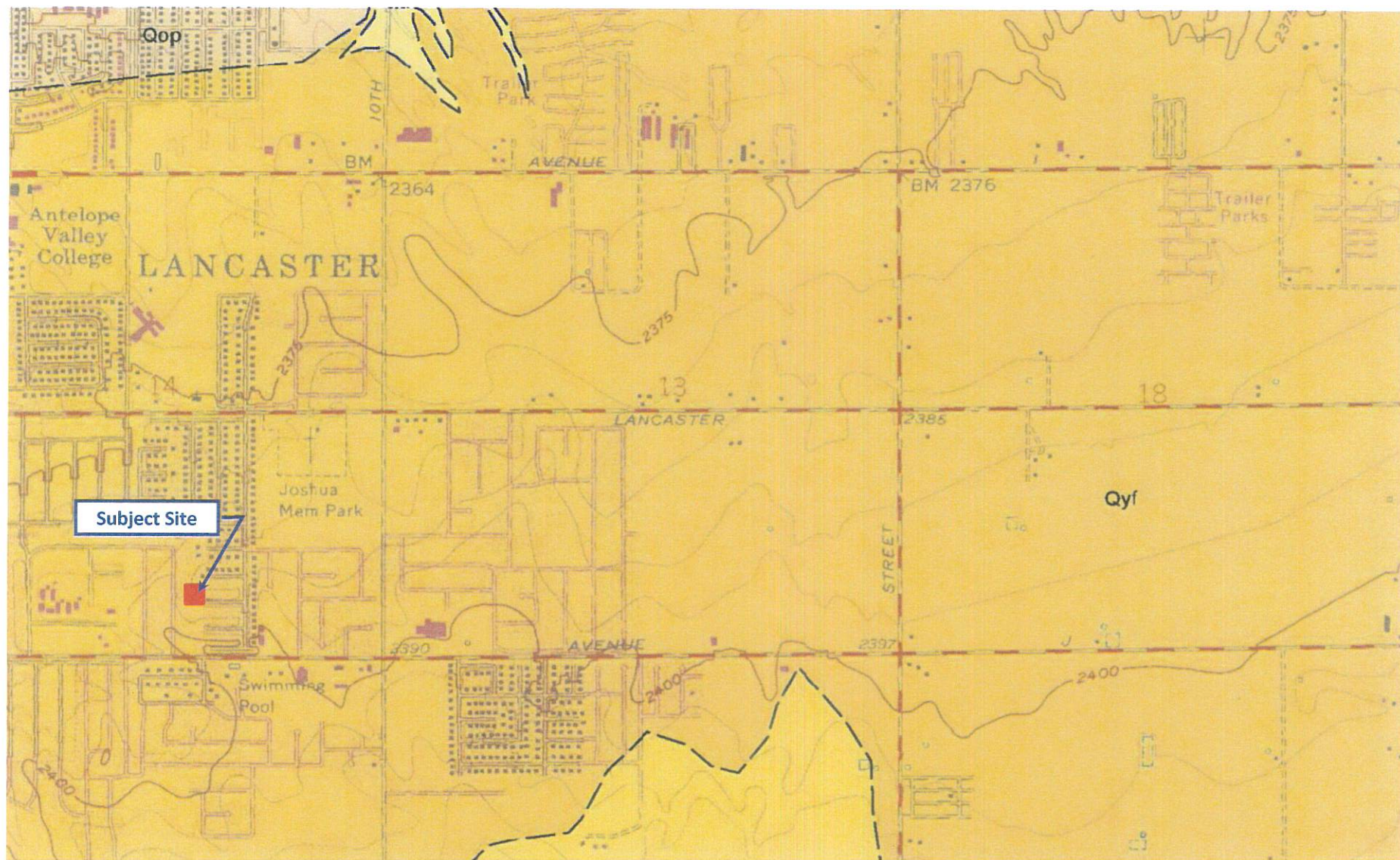
Generally, seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations in groundwater levels from the short-term observations made in ASE's exploratory borings cannot be ruled out. Please note, ASE's exploratory borings were not meant for groundwater monitoring.

The use of hollow-stem augers during drilling precluded observation of potential caving conditions which may have otherwise occurred in an uncased hole. Caving and/or sloughing were not observed and/or measured during the extraction of auger stem at the completion of boring operations. However, caving and/or soil sloughing cannot be ruled out in excavations greater in dimension/depth than our exploratory borings.

### **2.4     Utilities**

No overhead or underground utilities were encountered within the area of ASE's on-site investigation. However, overhead solar panels supported on pier foundations are present in the area of planned Parking Lot extension. Underground utilities also provide service to the existing building on-site. In addition, underground utilities are along streets adjacent to the Site, along with light standards. Other utilities, though not known at the time of this report preparation, may be present on site, and should be located and incorporated into site development plans accordingly.





(Partial Extract of the Preliminary Geologic Map of the Lancaster East 7.5-Minute Quadrangle: a Digital Database, Version 1.0, California Geologic Survey, 2011)

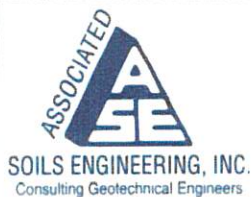
LEGEND



Approximate Site Location

Qyf

Younger Alluvial Fan Deposits- fine to medium sand w/ fine to coarse gravel associated w/ Amaragosa Creek, Little Rock Creek, and Creosote Canyon



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Project:

Proposed Park Improvements  
44501 5th Street East, Lancaster, CA

Figure 2

Local Geologic Map

Proj. No.:

7111.23

Date:

April, 2023



### 3.0 FAULTING AND SEISMICITY

Lancaster, like the rest of southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto, Newport-Inglewood and Whittier-Elsinore fault zones, as well as the east-west trending Garlock Fault.

By the definition of CGS, an active fault is one which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). The CGS has defined a potentially active fault as any fault which has been active during the Quaternary Period (approximately the last 1,600,000 years). These definitions are used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic Hazard Zones Act of 1972 and as subsequently revised in 1997 as the Alquist-Priolo Earthquake Fault Zoning Act and Earthquake Fault Zones. The intent of the act is to require fault investigations on sites located within Special Studies Zones to preclude new construction of certain inhabited structures across the trace of active faults. The Site is not located within the Alquist-Priolo Earthquake Fault Zone.

Several sources were researched for information pertaining to site seismicity. The majority of data was obtained from the program, EQFAULT, by Blake (2000) that allows for an estimation of peak horizontal ground acceleration (PGA) using a data file of approximately 150 digitized California faults. This program compiles information including the dominant type of faulting within a particular region, the maximum earthquake magnitude each fault is capable of generating, the estimated slip-rate for each fault, and the approximate location of the fault trace. Printouts of the results of the fault search for the Site are shown as Plates I-1 and I-2 in Appendix B.

#### 3.1 Deterministic Analysis

The Site is likely to be subject to strong seismic ground shaking during the life of the improvements. Based on the referenced literature and deterministic analysis performed with the EQFAULT software, the San Andreas Fault, approximately 8.6 miles (13.9 km) from the Site, would probably generate the most severe site ground motions. A Maximum Probable Earthquake (MPE), i.e. the maximum earthquake that is considered likely to occur during a 100-year time interval, of 8.0 Mw (moment magnitude as per USGS) has been assessed along the San Andreas Fault (Whole M-1a). As shown on Plate I-2 in Appendix B, estimated PGA from a MPE event on the San Andreas Fault is on the order of 0.361g should this event occur at the fault's closest approach to the Site. Other nearby active faults include the Sierra Madre Fault and the San Gabriel Fault, located approximately 24.2 miles (39.0 km) and 26.6 miles (42.8 km) away, respectively. In sum, approximately 46 active or potentially active faults have been found within 62 miles (100 km) of the Site.

### 3.2 Probabilistic Analysis

The seismicity of the Site was evaluated utilizing probabilistic analysis available from USGS Unified Hazard Tool (<https://earthquake.usgs.gov/hazards/interactive/>). The Maximum Probable Earthquake (MPE) and the Maximum Considered Earthquake (MCE) that carry 10 percent and 2 percent exceedance probabilities, respectively, in 50 years have been considered. Based on a typical damping ratio of 5% and a  $V_s^{30}$  value of 259 m/sec, corresponding with Site Class D, nearest to the derived a  $V_s^{30}$  value of 294 m/sec from the "Set Site Parameters for Web Services" function as part of the "Hazard Spectrum Calculator (Local)" application available from the "OPENSHA" website, three spectral acceleration values representing peak ground acceleration (PGA), spectral acceleration for structural period of 0.2 second ( $S_a - 0.2$  sec; typical of low-rise buildings) and spectral acceleration for structural period of 1.0 second ( $S_a - 1.0$  sec; typical of multi-story buildings) have been analyzed and are tabulated below.

Seismic Acceleration Values from USGS's Unified Hazard Tool						
Latitude	Longitude	$V_s^{30}$ (m/sec)	Scenario	Acceleration (g)		
				PGA	$S_a - 0.2$ sec	$S_a - 1.0$ sec
N 34.6920°	W 118.1235°	259	MPE <sup>1</sup>	0.424	0.970	0.661
			MCE <sup>2</sup>	0.747	1.635	1.371

1. MPE scenario carries a 10% exceedance probability in 50 years.

2. MCE scenario carries a 2% exceedance probability in 50 years.

### 3.3 2022 CBC Seismic Design Parameters

The earthquake design requirements listed in 2022 CBC and other governing standards account for faults classified as "active", in accordance with the most recent fault listing as per the United States Geological Survey (USGS) or the CGS. The seismic design of the proposed structures should be implemented in accordance with the applicable provisions stipulated in 2022 CBC unless otherwise specified by the governing authority having jurisdiction over the project. The 2022 CBC seismic design criteria for the Site based on a Site Class of "D", a Risk Category II and a scenario of Risk-Targeted Maximum Considered Earthquake ( $MCE_R$ ) that carries a 2% exceedance probability in 50 years had been determined utilizing the OSHPD Seismic Design Maps web-application (<http://seismicmaps.org>) and the criteria stipulated in Chapters 11 and 12 of ASCE 7-16 (Reference 12). Summaries of the seismic coefficients for the Site are tabulated on next page.



2022 CBC SEISMIC DESIGN PARAMETERS					
Site Latitude:	N 34.6920°	Site Longitude:	W 118.1235°	Risk Category <sup>a</sup>	II
Seismic Parameter				Recommended Value	
Site Class <sup>b</sup>				D	
Soil Profile Name <sup>b</sup>				Stiff Soil	
Site Coefficient, $F_a$ <sup>c</sup>				1.0	
Site Coefficient, $F_v$ <sup>d</sup>				1.7	
0.2-Second Spectral Response Acceleration, $S_s$ <sup>e</sup>				1.5g	
1.0-Second Spectral Response Acceleration, $S_1$ <sup>f</sup>				0.6g	
Adjusted 0.2-Second Spectral Response Acceleration, $S_{MS}$ <sup>g</sup>				1.5g	
Adjusted 1.0-Second Spectral Response Acceleration, $S_{M1}$ <sup>h</sup>				1.02g	
Design 0.2-Second Spectral Response Acceleration, $S_{DS}$ <sup>i</sup>				1.0g	
Design 1.0-Second Spectral Response Acceleration, $S_{D1}$ <sup>j</sup>				0.68g	
Long -Period Transition Period, $T_L$ <sup>k</sup>				8 sec	
Mapped $MCE_G$ Geometric Mean Peak Ground Acceleration, $PGA$ <sup>l</sup>				0.562g	
Site Coefficient, $F_{PGA}$ <sup>m</sup>				1.1	
$MCE_G$ Peak Ground Acceleration adjusted for Site Class Effect, $PGA_M$ <sup>n</sup>				0.619g	
Risk Category			I or II or III	IV	
Seismic Design Category based on $SD_S$ <sup>o</sup>			D	D	
Seismic Design Category based on $SD_1$ <sup>p</sup>			D	D	

a Per 2022 CBC Table 1604.5

b Per 2022 CBC Section 1613.2.2

c Per 2022 CBC Table 1613.2.3(1). *Note: For Site Class "D", if simplified design procedure of Section 12.14 of ASCE 7-16 is adopted, the  $F_a$  value should be determined per Section 12.14.8.1 of ASCE 7-16 with no need for  $F_w$ ,  $S_{MS}$ ,  $S_{M1}$  values.*

d Per 2022 CBC Table 1613.2.3(2). *Note: For Site Class "D", the value is applicable provided  $C_s$  values are determined by Equations 12.8-2, 12.8-3 and 12.8-4 of ASCE 7-16.*

e Per 2022 CBC Figure 1613.2.1(1)

f Per 2022 CBC Figure 1613.2.1(2)

g Per 2022 CBC Equation 16-36

h Per 2022 CBC Equation 16-37

i Per 2022 CBC Equation 16-38

j Per 2022 CBC Equation 16-39

k Per ASCE 7-16 Figure 22-14

l Per ASCE 7-16 Figure 22-9

m Per ASCE 7-16 Table 11.8-1

n Per ASCE 7-16 Equation 11.8-1 =  $PGA \times F_{PGA}$

o Per 2022 CBC Table 1613.2.5(1)

p Per 2022 CBC Table 1613.2.5(2)

Please note, seismic design parameters for Site Classes "D", "E", and "F" should be obtained from site-specific seismic hazard analysis unless exceptions stipulated in Section 11.4.8 of ASCE 7-16 are invoked. The values listed in the following table reflect such exception invocation (see footnotes c and d beneath the above table). If the structural design of the Park Improvements cannot be supported by the invoked exceptions, the Geotechnical Consultant should be contacted for performing additional, site-specific seismic hazard analysis such that values of site-specific design parameters could be established.

Also note that conformance to the 2022 CBC seismic design criteria does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not take place during the occurrence of a  $MCE_R$  event. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive. Following a major earthquake, a building may be damaged beyond repair, yet not collapse. The Structural Consultant should review the pertinent parameters to evaluate the seismic design.

## **4.0 Geologic Hazards**

### **4.1 Flood Hazards**

The Site was located on the Los Angeles County Public Works Flood Zone Determination Map site. The Site is not located within the limits of the 100-year flood plain. The Site is located in Flood Zone X, an area of 0.2-percent-annual-chance flood, and an area shown as 1-percent-annual-chance flood hazard with average depth less than one (1) foot or with drainage areas of less than one (1) square mile.

## **5.0 LABORATORY TESTING**

### **5.1 Direct Shear Test**

For the determination of shear strength parameters of representative soil samples, direct shear tests were performed on selected relatively undisturbed soil samples in accordance with ASTM D3080-11 Test Method. The test results are presented on Plates D-1 through D-5 in Appendix A.

### **5.2 Consolidation Test**

Consolidation tests were performed on selected relatively undisturbed soil samples retained in the rings of the Modified California barrel sampler in general accordance with the latest version of ASTM D2435-11 Test Method. The percent consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of these tests are presented on Plates C-1 and C-2 in Appendix A.

### **5.3 Moisture Content and Density Tests**

Moisture content and in-place density tests were performed on the relatively undisturbed soil samples retained within the rings of the Modified California barrel sampler. Test results are presented on the Field Logs of Borings ("B" Plates) in Appendix A.

### **5.4 Maximum Dry Density/Optimum Moisture Content Test**

A maximum dry density/optimum moisture content test is meant to determine the compaction characteristics of a representative site soil sample. The test was conducted in accordance with ASTM D1557-12 Test Method, Method A, using 5 equal layers, 25 blows each layer, 10-pound hammer, 18 inch drop in a 1/30 cubic foot mold. The results are presented in Appendix A.

### **5.5 Expansion Test**

An expansion test is meant to determine if soils exhibit expansive soil properties that may adversely affect the planned structural development. The test was conducted in accordance with ASTM D4829-19 Test Method. The expansion sample was remolded to approximately 90 percent relative compaction at near



optimum moisture content, subjected to a nominal surcharge load, and saturated. The results are presented in Appendix A.

## **5.6     Soil Corrosivity Tests**

Tests of soluble sulfate and chloride contents were performed in accordance with the latest edition of California Test Methods (CTM's) 417 and 422, respectively, to assess the degree of corrosivity of the subgrade soils with regard to concrete and normal grade steel. Resistivity and pH-value tests were performed in accordance with ASTM G187-18 Test Method and the latest CTM 643, respectively, to assess the degree of corrosivity of the subgrade soils with regard to ferrous metal piping. The test results are presented in Appendix A.

## **6.0     GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS**

Based on ASE's field exploration, laboratory testing, engineering analysis, past successful experience and professional judgement, it is ASE's professional opinion that the major geotechnical factors affecting the design and construction of the Park Improvements include the following:

1. Soil disturbances as a result of site demolition, clearing and excavation operations.
2. Presence of loose, low density soils within the zone of foundation bearing strata.

In consideration of the above factors, it is ASE's opinion that overexcavation and backfilling with properly compacted fill in the areas of Park Improvements, as recommended herein, will be essential to reduce unfavorable foundation displacement as a consequence of settlement of underlying soils, and to provide satisfactory bearing stratum for the Park Improvements, including new footings/foundations, asphaltic concrete (AC) pavements, slabs and other appurtenant construction. The grading recommendations provided herein should be reviewed when grading plans become available. It is assumed that the interior and exterior finish grades will be close to existing site grades ( $\pm$  one foot).

Conventional footing foundations, bearing on approved compacted fill soils are deemed suitable for support of planned structural improvements (e.g. site walls). CIDH short piers are considered suitable for supporting light poles, signage poles or shade structures.

## **6.1     Site Preparation**

### **6.1.1   Existing Improvements:**

Prior to ground preparation, it will be necessary to remove designated existing construction, including any remaining buried obstructions, which may be in the areas of the proposed Park Improvements construction. Structure removal should include, but not be limited to, abandoned

foundations, concrete flatwork and pavements. Asphalt and concrete fragments from site demolition operations should be disposed of off-site.

#### 6.1.2 Surface Vegetation:

Surface vegetation should be stripped from areas of proposed construction. Stripping should penetrate six (6) inches into surface soils. Any soil contaminated with organic matter (such as root systems or strippings mixed into the soil) should be disposed of off-site or set aside for future use in non-structural landscaped areas. Removal of trees and shrubs should include rootballs and attendant root systems.

#### 6.1.3 Underground Utilities:

If shallow utility lines are present in the area of proposed construction, it may be necessary to either reroute the existing shallow utility lines below the bottom elevation of recommended soil rework as outlined below or protect utilities in-place. During subgrade rework and recompaction of site soils as recommended below, care should be taken to prevent damage to underground lines.

Alternatively, deep hollow lines may be left in place provided they are filled with concrete or 2-sack control density fill (slurry fill). No filled line should be permitted closer than two (2) feet from the bottom of future footings, unless it has been pre-approved by the Geotechnical Consultant.

However, local ordinances relative to abandonment of underground utilities, if more restrictive, will supersede the above minimum requirements.

### 6.2 Site Grading

In view of reducing the adverse effects associated with the development of excessive total or differential static settlement underneath the Park Improvements, as well as to ensure uniform bearing competency for the footing foundations, preparation of subgrade soils are recommended as follows.

#### 6.2.1 Undocumented Fill/Disturbed Native Soils:

Although not observed in ASE's exploratory borings, any undocumented fill soils, if encountered during site grading in the areas of the Park Improvements, as well as any native soils disturbed during demolition and clearing operations, should be excavated full depth under the observation and confirmation by the Geotechnical Consultant. Lateral extent of overexcavation beyond the Park Improvement perimeters, where possible, should be at least equal to the depth of undocumented fill/disturbed soil encountered or one (1) foot, whichever is greater.

The exposed excavation bottom should be scarified/reworked to a minimum nine (9) inches depth and recompact to a minimum 90 percent relative compaction with a minimum moisture content of one (1) percentage point above optimum moisture content prior to backfilling with approved soils as specified in Section 6.2.6. Unless otherwise stated, the measurement of relative compaction in this report should always refer to ASTM D1557-12 Test Method.

If encountered, removal of undocumented fill will not be required in the area where light poles/signage poles/solar panels to be supported by CIDH piers are not surrounded by surface improvements (i.e. AC paving or PCC slabs/flatwork).

#### 6.2.2 Expansive Soils:

Laboratory test results on a near surface soil sample indicates a "Very Low" soil expansion potential (i.e. Expansion Index, EI = 0 per ASTM D4829-19 Test Method) as defined in 2022 CBC. It may be desirable that the soil expansion potential be re-evaluated through additional testing during or after rough grading operations to verify the design adequacy of shallow foundation, pavements or slab-on-grade against the re-tested soil expansion potential as heterogeneity within soil mass is not uncommon.

#### 6.2.3 Remedial Grading:

To provide more uniform and firm support for conventional footing foundations supporting any planned Improvement structures (i.e. footings, site walls, equipment pads, etc.), it is recommended that the on-site soils to a depth of two (2) feet below existing grade, or one (1) foot below the bottom of footing, whichever is greater, be overexcavated uniformly, then backfilled with compacted fill soils moisture conditioned to a minimum moisture content of one (1) percentage point above the optimum moisture content, and recompact in-place to achieve a minimum 90 percent relative compaction per ASTM D1557-12 Test Method. The overexcavation should extend laterally at least one (1) foot beyond the footing perimeters, wherever possible. The exposed excavation bottom should be scarified/reworked to a minimum depth of nine (9) inches and recompact to a minimum 90 percent relative compaction with a minimum moisture content of one (1) percentage point above optimum moisture content prior to backfilling with approved soils.

The compacted fill within the Park Improvement areas should consist of "Very Low" expansive ( $EI \leq 20$ ), granular material, compacted to at least 90 percent relative compaction with minimum moisture content of one (1) percentage point above optimum moisture content. On-site subgrade soils as tested exhibit satisfactory EI and, thus, are deemed suitable for re-use as compacted fill. However, additional EI testing should be performed on excavated site soils during grading.



In case of the presence of localized loose soils, the overexcavation needs to be deepened accordingly to delete the loose soil condition. However, this deepened overexcavation may be terminated when the exposed native, undisturbed soils exhibit a natural relative compaction greater than 85 percent, subject to the testing and inspection by the representative from the Geotechnical Consultant.

The Geotechnical Consultant's field representative should be provided with appropriate foundation details and staking during grading to verify that depths and/or locations of the recommended overexcavation are adequate. For areas on site that grading recommendations stipulated in both Sections 6.2.1 and 6.2.3 apply, the more stringent ones between the two sections should govern.

The depth of overexcavation should be reviewed by the Geotechnical Consultant during the actual construction. Any subsurface obstruction, buried structural elements, and unsuitable material encountered during grading, should be immediately brought to the attention of the Geotechnical Consultant for proper exposure, removal and processing, as recommended.

#### 6.2.4 Slab-on-Grade/Flatwork/Hardscape/Pavement Subgrade Preparation:

For the purpose of reducing future unsightly and uneven movements and cracks of any new slab-on-grade, flatwork, hardscape, or pavement, it is recommended that subgrade soils to depth of twelve (12) inches below the bottom of and twelve (12) inches laterally beyond the footprint of concrete slab-on-grade/flatwork/hardscape/pavement be overexcavated and recompact to at least 90 percent relative compaction with a minimum moisture content of one (1) percentage point above optimum moisture content. Prior to placement of compacted fill, the upper six (6) inches of exposed native subgrade should be reworked to at least 90 percent relative compaction with a minimum moisture of one (1) percentage point above optimum moisture content. However, if undocumented fill is encountered in these areas, recommendations stipulated in Section 6.2.1 above should be complied with. Please note that, from geotechnical viewpoint, new landscape area with only softscape is not subject to subgrade preparation and remedial grading requirements mentioned in Sections 6.2.1, 6.2.3, and 6.2.4.

#### 6.2.5 Suitable Soils and Imported Soils:

Unless otherwise noted, any soil re-used or imported as fill for the completion of subgrade preparation should consist of predominantly "Very Low" to "Low" expansive ( $EI \leq 30$ ), granular material, and should be exhibiting a relatively uniform gradation, free of debris, particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials. Unless otherwise approved by the Geotechnical Consultant, the imported fill materials should also comply

with the following soil corrosivity criteria with respect to the desired concrete and reinforcement protection.

Corrosivity Criteria for Select Fill and General Fill			
Soluble Sulfate (% by weight) <sup>(1)</sup>	Soluble Chloride (ppm) <sup>(2)</sup>	Resistivity Value (ohm-cm) <sup>(3)</sup>	pH-Value <sup>(4)</sup>
≤ 0.1	≤ 500	≥ 2000	7.0 ~ 8.8

(1) California Test Method 417. (2) California Test Method 422. (3) ASTM G187-18 Test Method. (4) California Test Method 643.

Imported fill soils or base materials should be examined by a representative of this office and tested as necessary for evaluating their suitability for use as fill prior to being hauled to the Site. Final acceptance of any imported soil will be based upon review and testing of the soil actually delivered to the Site. All blended soils to be used as fill must be tested and approved by the Geotechnical Consultant prior to being used for fill placement.

#### 6.2.6 Backfilling and Compaction Requirements:

Existing site soils at their present state and composition, unless indicated or tested otherwise, are considered suitable for re-use as fill during subgrade preparation, provided they are 1) free of debris, particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials, 2) are not environmentally contaminated, and 3) adequately aerated or moisture conditioned to permit achieving the required compaction. No nesting of large particles (2 to 4-inch size) should be permitted during backfilling operations.

On-site soils and import materials approved for use as fill should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to a minimum of one (1) percentage point above optimum moisture content, and compacted to a minimum of 90 percent relative compaction per ASTM D1557-12 Test Method, unless otherwise stated.

#### 6.2.7 Tests and Observations:

All subgrade preparation, compaction, and backfill operations should be performed under the observation of and testing by the Geotechnical Consultant's field representative. An adequate number of field tests should be taken to ensure compliance with this report and local ordinances. If it is determined during grading that site soils require overexcavation to greater depths for obtaining proper support for the proposed structures, this additional work should be performed in accordance with the recommendations of the Geotechnical Consultant.

### 6.3 Foundation Design

It is ASE's opinion that conventional continuous spread footings and isolated pad footings bearing on approved compacted fill soils may be used to provide foundation support for any planned Improvement

structures (i.e. footings, site walls, equipment pads, etc.), provided that the site grading recommendations presented in Section 6.2 above are incorporated in project planning and design, and implemented during site construction. For the support of light poles/shade structures, ASE recommends consideration of CIDH piers.

#### 5.3.1 Conventional Shallow Footing Foundation:

##### a) Minimum Footing Dimension and Reinforcement:

In order to mobilize sufficient soils bearing capacity supporting the new footings for any planned Improvement structures, it is recommended that the following tabulated minimum footing embedments, widths and reinforcements for various footing types tabulated below be considered.

<b>Minimum Footing Dimension &amp; Reinforcement</b>					
<b>Continuous Spread Footing/Strip Footing</b>			<b>Isolated Pad Footing</b>		
<b>Depth (in) <sup>(1)</sup></b>	<b>Width (in)</b>	<b>Reinforcement <sup>(2)</sup></b>	<b>Depth (in) <sup>(1)</sup></b>	<b>Width (in)</b>	<b>Reinforcement <sup>(2)</sup></b>
12	12	Two #4 bars – one near the top and one near the bottom	12	18 square	Two #4 bars – one near the top and one near the bottom, applied bi-axially

(1) Footing embedment measured from the nearest adjacent lowest soils grade

(2) Based strictly from geotechnical point of view.

Foundation design details such as concrete strength, reinforcements, etc. should be established by the Structural Consultant.

##### b) Allowable Soils Bearing Capacity:

For footings complying with the minimum dimension requirements stipulated in Section 6.3.1 a) above, the allowable soils bearing capacities, inclusive of both dead and live loads, should be as per tabulated below:

<b>Allowable Soils Bearing Capacity (psf)</b>		<b>Increase per 12-inch Increment in Footing Width (psf)</b>	<b>Increase per 12-inch Increment in Footing Depth (psf)</b>	<b>Maximum Composite Ceiling Value (psf)</b>
<b>Continuous Spread Footing/Strip Footing</b>	<b>Isolated Pad Footing</b>			
1,800	1,800	200	400	3,500

The above allowable bearing capacities may be increased by one-third (1/3) when subject to short-term, transient loading induced by wind or seismic activities.



c) Lateral Resistance:

Resistance to lateral loads can be assumed to be provided by passive lateral earth pressure and by friction acting on structural components in permanent contact with the subgrade soils.

For site preparation implemented as per recommended in the above Section 6.2, lateral resistance on the sides of foundations may be computed using a passive lateral earth pressure of 220 pcf EFP for footings embedded into approved compacted fill soils, subject to a maximum of 2,200 psf. An ultimate coefficient of friction on the order of 0.4 may also be used for structural dead load acting between the footing bottom and the supporting soils. The above passive lateral earth pressure may be used in conjunction with the ultimate coefficient of friction in calculating composite lateral resistance, provided the passive lateral earth pressure value is reduced by one-third (1/3). The composite lateral resistance may be increased by one-third (1/3) under short term, transient wind or seismic loading.

d) Static Settlements:

Total static settlements resulting from compression of subgrade soils for new conventional footings designed and constructed in accordance with the above criteria, and supporting maximum assumed dead plus live (D+L) column and wall loads mentioned in Section 1.1.2 above, are not anticipated to exceed one-half (1/2) inch, upon implementation of site preparation as per recommended in Section 6.2 above. A differential settlement on the order of one-quarter (1/4) inch is anticipated between similarly loaded adjacent new pad footings, as well as for new continuous wall footings over a distance of approximately 30 feet.

Please be reminded that the Geotechnical Consultant should be contacted for further evaluation and recommendations, as necessary, should final design structural loads exceed the maximum loads assumed in the above analyses by more than ten (10) percent.

6.3.2 CIDH Piers for Support of Lighting/Shade Structures/Playground Equipment:

a) Allowable Soils Bearing Capacity:

For the Lighting/Shade Structures/Playground Equipment to be supported by CIDH piers having a minimum embedment of five (5) feet, at least 18 inches in diameter, and spaced no closer than three (3) diameters on centers, an allowable soils bearing capacity of 4,000 psf may be used for end-bearing consideration. An increment of end bearing capacity of 400 psf for each 12-inch increase of CIDH pier depth beyond five (5) feet may be considered, subject to a ceiling value not exceeding 6,000 psf. An allowable skin friction on the order of 100 pcf for the portion of CIDH piers greater than a depth equivalent to one (1) pier diameter from grade may also be considered provided the aforementioned allowable soils bearing capacity value is reduced one-

third (1/3) when used conjunctively. If any Lighting/Signage Pole/Solar Panel is supported by metal poles penetrated directly into the ground, then skin friction should be neglected.

b) Lateral Resistance:

For the consideration of passive resistance for the CIDH piers, lateral resistance to the foundations may be computed using a passive lateral earth pressure of 220 pcf EFP for foundations embedded into site soils, subject to a maximum of 2,200 psf. An ultimate coefficient of friction on the order of 0.4 may also be used for structural dead load acting between the CIDH pier bottom and the supporting soils. In addition to these values, a multiplier of 1.5 may be considered for CIDH piers spaced no closer than 3 diameters on centers. Please note that the upper portion of CIDH pier equivalent to one time of pier diameter should be excluded from lateral resistance consideration due to anticipated installation-induced disturbance.

c) Settlements:

When designed and constructed as per recommended above, the CIDH piers are anticipated to experience a total settlement not exceeding one-half (1/2) inch, and a differential settlement not exceeding 1/4 inch between any two (2) nearest piers.

d) General Guidelines for CIDH Pier Installation:

- Pier excavations should be drilled with suitable equipment and should not be out-of-plumb by more than 0.5 percent of the pier length.
- Casing should be used during drilling of any pier extending within the sand layers, or below groundwater elevation, in the event caving conditions are experienced.
- All pier excavations should be cleaned of loose soils and cuttings.
- A representative of the Geotechnical Consultant should be present during all pier drilling operations to verify pier embedment depths and acceptability of bearing strata.
- After completion of drilling at each pier location and approval by the Geotechnical Consultant or his representative, reinforcing steel and concrete should be placed the same day to minimize soil moisture loss in excavation sidewalls and potential caving conditions.
- The placement of reinforcement and concrete should conform to ACI and other applicable code requirements.



- Considerations should be given to the placement of concrete by tremie method, especially for piers extending below groundwater elevation. Care should be taken to prevent striking the walls of the excavations with the tremie pipe during concrete placement.
- If casing is used, concrete placement and casing removal should be done in stages such that the casing bottom is always as a minimum of 3 feet below the top of concrete.
- Pier drilling and installation equipment and procedures proposed by the contractor should be reviewed by the Geotechnical Consultant.
- The designer should take into account soil corrosivity values presented in Section 6.8 below.

#### 6.3.3 Retaining Walls:

It is ASE's understanding that there is no retaining wall planned as part of the Improvements construction. If design or planning change requires the construction of retaining wall, ASE should be consulted for pertinent retaining wall design parameters and construction guidelines.

#### 6.3.4 Footing/Foundation Observation:

All footing/foundation excavations should be observed by the Geotechnical Consultant's representative to verify minimum embedment depths and competency of bearing soils. Such observations should be made prior to placement of any reinforcing steel or concrete.

### 6.4 Slabs-On-Grade

Exterior concrete flatwork/hardscape should be supported on properly compacted soils as recommended in Section 6.2 above. The slab subgrade soils should also be proof-rolled just prior to construction to provide a firm, unyielding surface, especially if the subgrade has been disturbed or loosened by the passage of construction traffic. Final compaction and testing of slab subgrade should be performed just prior to placement of concrete.

For structural design of concrete slabs, a modulus of subgrade reaction ("k") on the order of 180 pounds per square inch per inch (psi/in or pci) and an allowable bearing capacity of 1,000 psf may be used. Exterior slabs should be properly designed and reinforced for the construction and service loading conditions. To minimize future slab distress, geotechnically, it would be prudent to provide a minimum actual slab thickness of four (4) inches with minimum reinforcement consisting of number 3 reinforcing bars spaced maximum 24 inches on centers each way placed at mid-slab. The slab structural details, such as slab thickness, concrete strength, amount and type of reinforcements, joint spacing, etc., should be established by the Structural Consultant in accordance with pertinent sections in 2022 CBC.

Exterior slabs should be properly jointed to limit the number of concrete shrinkage cracks. For long/thin sections, such as sidewalks, expansion or control joints should be provided at spacing intervals equal to the width of the section. Slabs between 5 and 10 feet in minimum dimension should have a control joint at centerline. Slabs greater than 10 feet in minimum dimension should have joints such that unjointed sections do not exceed 10 feet in maximum dimension. Where flatwork adjoins structures, it is recommended that a foam joint or similar expansion material be utilized. Joint depth and spacing should conform to the ACI recommendations. It is, however, cautioned that uneven heaving of exterior slabs may develop in the future when prolonged irrigation or seepage permeates the subgrade soil, especially in areas that expansive soil pockets exist due to inadequate control or inspection of earthwork construction.

## 6.5 Asphaltic Concrete (AC) Flexural Pavement Design

The finish grade at the Site is anticipated to be underlain by compacted structural fill consisting of site soils. For preliminary pavement design purposes, an assumed R-Value of 20 has been utilized considering the potential heterogeneity within site silty sand soils. Three (3) traffic indices ("TI") of 4.5, 5.5 and 7.0, together with the tested R-Value, have been utilized for the development of preliminary recommendations for the pavement sections. Analyses performed in accordance with the current edition of the Caltrans Highway Design Manual, and assuming compliance with site preparation recommendations, it is recommended that the AC pavement structural sections tabulated below be considered:

Traffic Index (TI)	Pavement Section Alternatives		Remark
	AC (inches)	AB <sup>(1)</sup> (inches)	
4.5	3.0	6.0	For auto parking stalls.
5.5	3.0	9.0	For auto circulation aisles.
	4.0	7.0	
7.0	4.0	12.0	For fire lanes and truck access ways/entry and exits.
	5.0	10.0	

(1) CAB per the Greenbook section 200-2.2, compacted to at least 95% relative compaction.

Please be reminded that the preliminary pavement section recommendations have been established based purely on procedures stipulated in Caltrans Manual. Local governing agency should be consulted for minimum pavement section requirements and, if more stringent than that recommended by ASE, be complied with. It is recommended that R-Value testing be performed on subgrade soil samples after rough grading on the upper two (2) feet to confirm/modify applicability of the above pavement sections.

The aggregate base should conform to the criteria of Crushed Aggregate Base (CAB) or Crushed Miscellaneous Base (CMB) stipulated in Sections 200-2.2 or 200-2.4 of the latest edition of the Standard Specifications for Public Works Construction (the Greenbook), respectively. The base course should be compacted to a minimum relative compaction of 95% at a minimum of one (1) percentage point above the



optimum moisture content. Field testing should be used to verify compaction, aggregate gradation, and compacted thickness. The asphalt concrete pavement should be compacted to 95% of the unit weight as tested in accordance with the Hveem procedure per the latest California Test Method (CTM) 304. The asphalt concrete material shall conform to Type III, Class C2 or C3, of the Greenbook. All subgrade and aggregate base materials should be proof-rolled by heavy rubber tire equipment to verify that the subgrade and base grade are in a non-yielding condition. If the paved areas are to be used during construction, or if the type and frequency of traffic is greater than assumed in the design, the pavement section should be re-evaluated for the anticipated traffic.

## 6.6 Portland Cement Concrete (PCC) Pavements

The concrete pavement sections are based on load safety factors of 1.0 and 1.1, and a modulus of subgrade reaction ("k" Value) of 180 pounds per cubic inch for site soils compacted as subgrade material, and the design procedures presented in the Portland Cement Association bulletin "Thickness Design for Concrete Highway and Street Pavements" (EB109.01P), 1984. A design service life of 20 years was assumed for the design of the Portland cement concrete pavement section.

Concrete Flexural Strength (psi) <sup>(1)</sup>	Pavement Thickness (in) <sup>(2), (4)</sup>	Pavement Thickness (in) <sup>(3), (4)</sup>
600	5.5	6.5
650	5.0	6.0

- (1) Represents 90-day flexural strength. Based on Figure 10 of Reference 13, concrete with 28-day unconfined compressive strength values of 4000 to 4500 psi typically correlates to 90-day flexural strength values of 600 and 650 psi, respectively.
- (2) Load Safety Factor = 1.0 (Auto Parking Stalls)
- (3) Load Safety Factor = 1.1 (Fire Lanes/Truck Traffic Areas/Entry and Exits)
- (4) Assumes no PCC shoulder or curb.

The Structural Consultant should establish the design details of the concrete pavement section, including reinforcements, concrete strength, and joint and load transfer requirements.

It is recommended that edges of concrete pavements which are not adjacent to existing buildings, or are adjacent to planter areas, be downturned a minimum of 12 inches or be constructed with curbing to prevent water infiltration to subgrade soils. If edges are downturned or curbing is constructed, the above pavement thicknesses should be decreased by 1/2 inch.

The upper one (1) foot of exposed subgrade soils beneath concrete pavements should be further compacted to a minimum 95 percent relative compaction with a minimum moisture content of one (1) percentage point above optimum moisture content. Subgrade soils should exhibit a firm, unyielding surface in addition to the recommended compaction. Final compaction and testing of pavement subgrade should be performed just prior to placement of aggregate base and/or concreting. Other pertinent subgrade preparation measures stipulated in the "Thickness Design for Concrete Highway and Street Pavements" (EB109.01P), 1984, or required by the jurisdictional municipal authorities should be followed accordingly.

## 6.7 Site Drainage

Per Section 1804.4 of 2022 CBC, a minimum 5% descending gradient away from the Improvements for a minimum distance of 10 feet should be incorporated for earth grade placed adjacent to the foundation. This descending gradient may be reduced to 2% for any impervious areas, such as concrete paved walkways, within the 10-foot zone. For areas where the 10-foot drainage distance is not attainable, alternative measure such as concrete-lined swales having a minimum 2% gradient may be adopted to divert the water away from the Improvements, provided that a minimum 5% gradient is maintained in the distance between the building footprints and the diversion measure such as swales. For more specific site drainage guidelines, the Project Civil Consultant should refer to the pertinent sections in 2022 CBC.

Any planter areas to be placed adjacent to structure perimeters should be provided with impervious bottoms and a drainage pipe, or should be planted with drought tolerant plants, to divert water away from foundation and slab subgrade soils. Excessive moisture variations in site soils could result in significant volume changes and movement.

## 6.8 Soil Corrosivity Evaluation

Soils corrosivity tests were performed on representative samples of site soil. These tests are meant to determine the corrosive potential of on-site soils to proposed concrete foundations/flatwork and underground metal conduit. The soils corrosivity test results are presented in Appendix A.

### 6.8.1 Concrete Corrosion:

Disintegration of concrete may be attributed to the chemical reaction of soils sulfates and hydrated lime and calcium aluminate with the cement. The severity of the reaction resulting in expansion and disruption of the cement is primarily a function of the concentration of soluble sulfates and the water-cement ratio of the concrete.

A soluble sulfate content of 0.011% by weight have been recorded from testing per California Test Method (CTM) 417 conducted on on-site soils, as indicated in Appendix A. As per Table 19.3.1.1 of ACI 318-19, soils exhibiting soluble content less than 0.1% by weight are classified as having "S0" sulfate exposure category. As such, for structural features to be in direct contact with on-site soils, the requirements regarding the type of Portland cement or water-cement ratio pertinent to the tested "S0" sulfate exposure category, as per stipulated in Table 19.3.2.1 of ACI 318-19, should be followed.



### 6.8.2 Metal Corrosion:

In the evaluation of soil corrosivity to metal, the hydrogen ion concentrates (pH) and the electrical resistivity of the site and backfill soils are the principal variables in determining the service life of ferrous metal conduit. The pH of soil and water is a measure of acidity or alkalinity, while the resistivity is a measure of the soils resistance to the flow of electrical current.

Currently available design charts indicate that corrosion rates decrease with increasing resistivities and increasing alkalinities. It can also be noted that for alkaline soils, the corrosion rate is more influenced by resistivity than by pH.

A resistivity value of 4,510 ohm-cm per ASTM G187-18 Test Method coupled with a pH-value of 8.31 per CTM 643 classifies the on-site soils tested to be moderately corrosive to buried ferrous metals. Based on CTM 643, the year to perforation for 18-gauge steel in contact with soils of similar resistivity and pH-value is 47 years for the corrosive on-site soils. In lieu of additional testing, alternative piping materials, i.e. plastic piping, may be used instead of metal if longer service life is desired or required for utility pipes and fittings in direct contact with on-site soils. These resistivity values of on-site soils may also have implications to other building materials and depths of embedment for steel reinforcement, etc. It is recommended that a qualified corrosion consultant be engaged to review the building plans.

A soluble chloride content of 17 ppm was recorded in our laboratory tests per CTM 422. Per Caltrans guidelines and specifications (References 18 and 19), soils exhibiting soluble chloride contents exceeding 500 ppm are considered "corrosive". The soils are thus classified as "non-corrosive" per Caltrans criterion, and the special measure in terms of rebar protection against chloride corrosion under Exposure Class "CO" stipulated in Tables 19.3.1.1 and 19.3.2.1 of ACI 318-19 should be complied with.

## 6.9 Utility Trenches

All trenches should be backfilled with approved fill material compacted to relative compaction not less than 90 percent maximum dry density (ASTM D1557-12 Test Method). Care should be taken during backfilling to prevent utility line damage. The on-site soils may be used for backfilling utility trenches from one (1) foot above the top of pipe to the surface, provided the material is free of organic matter and deleterious substances. Any soft and/or loose materials or fill encountered at pipe invert should be removed and replaced with properly compacted fill or adequate bedding material.

The on-site soils may be suitable for bedding or shading of utilities subject to additional Sand Equivalent (SE) per ASTM D 2419-14 Test Method testing. Site or imported soils for pipe bedding should consist of non-expansive granular soils having a tested SE value not less than 30.

If sandy soils are used for trench backfill, the backfill should be topped with a minimum 2-foot thick cap of compacted fine-grained, cohesive soil. Also, a minimum 10-foot length of trench at the entrance and exit points of the Parking Lot/Improvements should be backfilled with fine-grained soils to serve as a plug to prevent water migration into structure foundation support zones.

The walls of temporary construction trenches may not be stable when excavated nearly vertical due to the potential for caving. Shoring of excavation walls or flattening of slopes will be required if excavation depths greater than 4 feet are necessary. Please note that trenches should be located so as not to impair the bearing capacity of soils or cause settlement under foundations. As a guide, trenches parallel to foundations should be clear of a 45-degree plane extending outward and downward from the edge of the foundations. All work associated with trenches, excavations and shoring must conform to the State of California Safety Code (CAL-OSHA).

#### **6.10 Plan Review, Observations and Testing**

When foundation and grading plans are completed, they should be forwarded to the Geotechnical Consultant for review of conformance with the intent of these recommendations.

All excavations should be observed by a representative of this office to verify minimum embedment depths, competency of bearing soils and that the excavations are free of loose and disturbed materials. Such observations should be made prior to placement of any fill, reinforcing steel or concrete. All grading and fill compaction should be performed under the observation of and testing by a Geotechnical Consultant or his representative.

### **7.0 FIELD PERCOLATION TEST DATA**

Initial seepage rates obtained during the "Reading Time Interval Test" in Borings B-P1, B-P2 and B-P3 after overnight pre-soaking indicated the time interval between readings should be 30 minutes maximum, i.e. the "Normal Soil" category. The percolation test was performed using the County of Los Angeles Public Works Publication GS200.1 procedures modified to test the cross sectional zone of typical soils within the level of anticipated storm water infiltration (e.g. approximately 1 foot to 5 feet below existing grade for Borings B-P1 and B-P3, and 5 feet to 10 feet below existing grade in Boring B-P2).

Field percolation testing was conducted on February 22, 2023. Stabilized field percolation test data indicates preadjusted percolation test rates of 3.33, 1.67 and 1.5 minutes per inch (mpi) for clean water at the locations of Borings B-P1, B-P2 and B-P3, respectively. Field percolation test data is presented on the attached Plates H-1 through H-3 in Appendix A.



Tabulated below are the results of percolation testing conducted at the locations of Boring B-P1, B-P2 and B-P3, including the infiltration rate derived from the procedures outlined in L.A. County Publication GS200.1.

Boring No.	Percolation Test Rate (Minutes/Inch)	Infiltration Rate* (Inches/Hour)
B-P1	2.11	0.571
B-P2	1.08	0.923
B-P3	1.29	0.952

\*Infiltration Rate derived from Porchet Method Conversion from Percolation Rate using a Factor of Safety of 2.

The rates presented above are anticipated to be the fastest rates that can be absorbed by the site soils at the boring locations. However, with time and depending on the degree of saturation of soils and other factors, the percolation rate may reduce which is typical for sewage disposal or stormwater dispersal fields. The results of the field percolation testing (i.e. measured infiltration rate greater than 0.3 inch per hour) indicate that site soils are deemed suitable for the planning and installation of an on-site stormwater LID system within the approximate upper one to ten (1-10) feet from existing grade.

## 8.0 CLOSURE

This report has been prepared for the exclusive use of **IDS Group, Inc.** (the Client) and their subconsultants for use in design and construction of the planned Park Improvements at El Dorado Park in the City of Lancaster. The report has not been prepared for use by other parties, and may not contain sufficient information for purposes of other parties.

The Client is responsible for ensuring the information and recommendations contained in this report are brought to the attention of the Owner or the other design consultants, incorporated into the project plans, and implemented by project contractors. This report should be named on project plans as a part of the project specifications.

We at ASE request and recommend notification should any of the following occur:

1. Final plans for site development indicate utilization of areas not originally proposed for construction.
2. Structural loading conditions vary from those utilized for evaluation and preparation of this report.
3. The site is not developed within 12 months following the date of this report.

If changes or delays do occur, this office should be notified and provided with finalized plans of site development for our review to enable us to provide the necessary recommendations for additional work and/or updating of the report. Any charges for such review and necessary recommendations would be at the prevailing rate at the time of performing review work.

The findings contained in this report are based upon our evaluation and interpretation of the information obtained from the limited number of test borings and the results of laboratory testing and engineering analysis. As part of the engineering analysis it has been assumed, and is expected, that the geotechnical conditions existing across the area of study are similar to those encountered in the test excavations. However, no warranty is expressed or implied as to the conditions at locations or depths other than those excavated. Should conditions encountered during construction differ significantly from those described in this report, this office should be contacted immediately for recommendations prior to continuation of work.

Our findings and recommendations were obtained in accordance with generally accepted current professional principles and local practice in geotechnical engineering and reflect our best professional judgment. We make no other warranty, either express or implied.

These recommendations are, however, dependent on the aforementioned assumption of uniformity and upon proper quality control of engineered fill and foundations. Geotechnical observations and testing should be provided on a continuous basis during grading at the site to confirm preliminary design assumptions and to verify conformance with the intent of our recommendations. If parties other than Associated Soils Engineering, Inc. are engaged to provide geotechnical services during construction, they must be informed that they will be required to assume complete responsibility for the geotechnical phase of the project by either concurring with the recommendations in this report or providing alternative recommendations.

This concludes our scope of services as indicated in our proposal dated February 15, 2023, however, our report is subject to review by the controlling authorities for the project. Any further geotechnical services that may be required of our office to respond to questions/comments of the controlling authorities after their review of the report will be performed on a time-and-expense basis as per our current fee schedule. We would not proceed with any response to report review comments/questions without authorization from your office.

We appreciate your business and are prepared to assist you with construction-related services.



## APPENDIX A

The following Appendix contains the substantiating data and laboratory test results to complement the engineering evaluations and recommendations contained in the report.

### Site Exploration

On February 20, 2023, field explorations were performed by drilling seven (7) test borings at the approximate locations indicated on the attached Boring Location Plan, Plate A. The exploratory borings were drilled by Choice Drilling, utilizing a truck mounted, CME 75 rotary drilling rig equipped with 8-inch diameter continuous flight, hollow-stem rotary augers. The borings extended to depths of 5 feet to 36 feet from the existing grades.

Continuous observations of the materials encountered in the boring were recorded in the field. The soils were classified in the field by visual and textural examination and these classifications were supplemented by obtaining bulk soil samples for future examination in the laboratory. Relatively undisturbed samples of soils were extracted in a Modified California barrel sampler lined with 2.416-inch diameter by one-inch-high rings and tipped with tapered cutting shoe. All samples were secured in moisture-resistant bags immediately after retrieval from exploratory boring to minimize the loss of field moisture, followed by timely transportation to ASE's laboratory for ensuing testing. Upon completion of exploration, the borings were backfilled with excavated materials and compacted by tamping.

Description of the soils encountered, depth of samples, field density and moisture content of tested samples, respective laboratory tests performed, as well as Modified California barrel sampler blow counts are presented in the attached Field Logs of Borings ("B" Plates).

Please note that the subsurface soils descriptions presented in the Field Logs of Boring have been interpreted from conditions exposed during the field investigation and/or information inferred from the reviewed geologic literature. As such, it is likely that not all of the subsurface conditions at the Site could be captured or represented. It is therefore essential that the Geotechnical Consultant's engineer or geologist should be on site during excavation/grading and foundation construction such that information/recommendations deciphered during preliminary geotechnical investigation phase could be verified and amended, as appropriate.

Plate A  
Plates B-1 through B-5

Boring Location Plan  
Field Logs of Borings

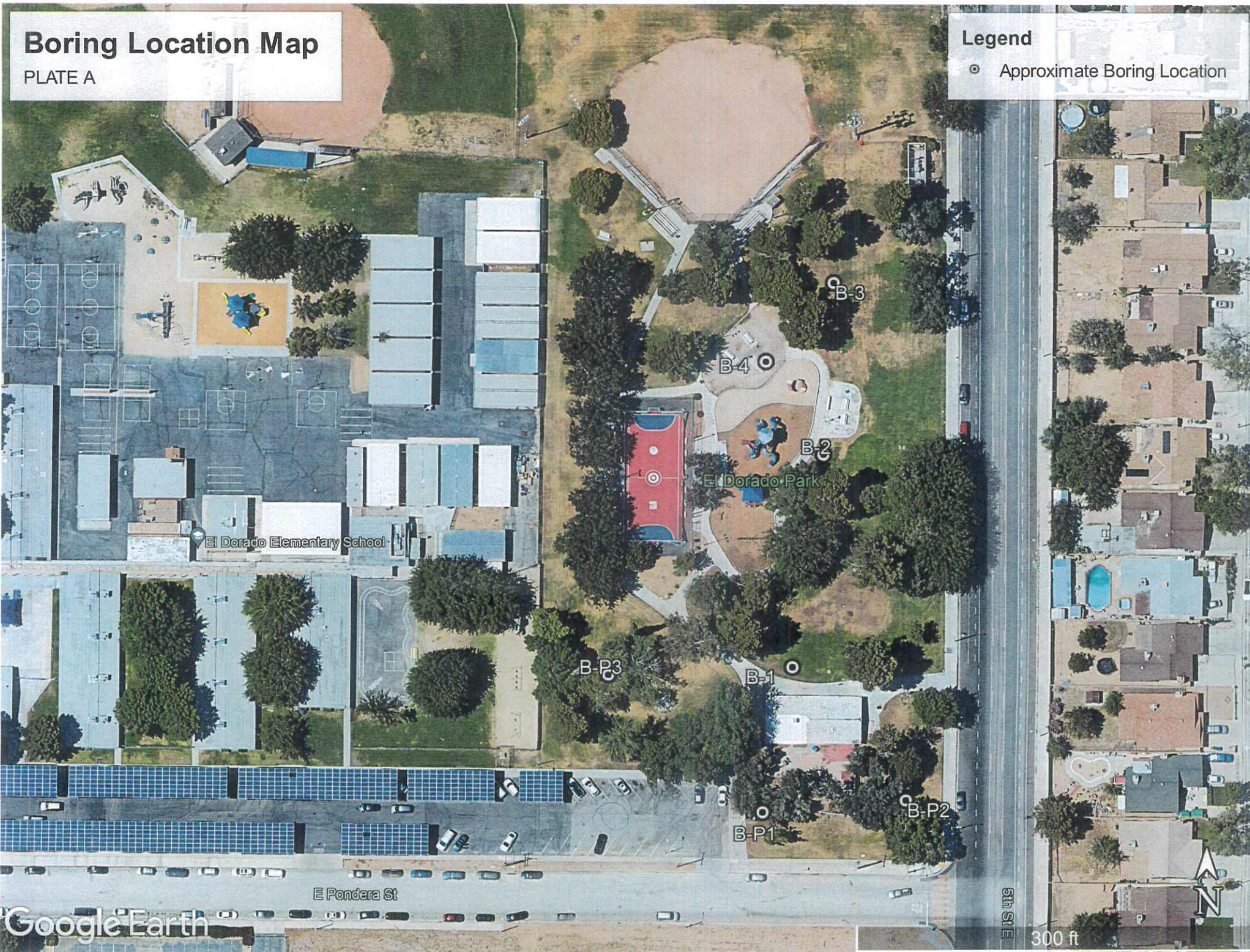


# Boring Location Map

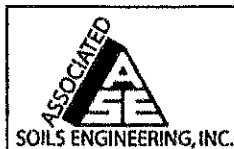
PLATE A

## Legend

- Approximate Boring Location







# FIELD LOG OF BORING B-1

Sheet 1 of 3

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

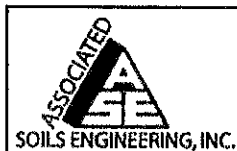
Location: **44501 5th Street East**

Project No. **7111.23**

Date(s) Drilled: **2/20/2023** Logged By: **John Whitney**  
 Drilled By: **Choice Drilling, Inc.** Total Depth: **36 feet**  
 Rig Make/Model: **CME75** Hammer Type: **Automatic**  
 Drilling Method: **Hollow-stem Auger** Hammer Weight/Drop: **140 Lb./±30In.**  
 Hole Diameter: **8 inches** Surface Elevation: **N/A**

Comments: **Grounwater encountered at 37 feet. Backfill not determined.**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SM	SILTY SAND: Brown, damp, fine to medium-grained sand				MAX DENSITY, EXPANSION, REMOLD SHEAR, CORROSIVITY
3				25(Ring)		SM	SILTY SAND: Brown, damp, fine to medium-grained sand, trace coarse gravel	109.7	4.1		CONSOL
5											
7				21(Ring)		SP	SAND: Mottled orange and olive brown, damp, medium to coarse-grained	107.1	3.0		SHEAR
10				8(SPT)		ML	SILT WITH SAND: Orange brown, moist, fine-grained sand		18.1		
15				22(Ring)		SP	SAND: Mottled olive and orange brown, medium to very coarse-grained sand	117.9	1.4		



# FIELD LOG OF BORING B-1

Sheet 2 of 3

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

Location: **44501 5th Street East**

Project No. **7111.23**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
20				16(SPT)		SP	SAND: Mottled olive, brown, and orange brown, damp, medium to coarse-grained sand		5.1		
25				56(Ring)		ML	SANDY SILT: Mottle light orange brown, moist, fine-grained sand	109.4	10.5		
30				19(SPT)		SM	SILTY SAND: orange grayish brown, moist, very fine to fine-grained sand		11.7		
35				40(Ring)		CL	SANDY CLAY: light gray, moist, fine to medium-grained sand	117.5	15.2		







# FIELD LOG OF BORING B-3

Sheet 1 of 2

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

Location: **44501 5th Street East**

Project No. **7111.23**

Date(s) Drilled: **2/20/2023** Logged By: **John Whitney**  
 Drilled By: **Choice Drilling, Inc.** Total Depth: **26 feet**  
 Rig Make/Model: **CME75** Hammer Type: **Automatic**  
 Drilling Method: **Hollow-stem Auger** Hammer Weight/Drop: **140 Lb./±30In.**  
 Hole Diameter: **8 inches** Surface Elevation: **N/A**

Comments: **Grounwater not encountered. Backfill not determined.**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SM	SILTY SAND: Orange brown, moist, fine-grained sand				MAX DENSITY, EXPANSION, REMOLD SHEAR, CORROSIVITY
3				6/6"(Ring)		SM	SILTY SAND: Orange brown, moist, fine to medium-grained sand	121.0	11.0		SHEAR
				6/6"(Ring)		SM	SILTY SAND: Orange brown, moist, fine-grained sand	110.7	6.8		
5											
7				20(Ring)			SANDY SILT: Light yellowish brown, damp, fine-grained sand	97.8	7.9		
10				8(SPT)		SM	SILTY SAND: light yellowish brown, damp to moist, fine-grained sand		10.6		
15				23(Ring)		SP	SAND: mottled orange and olive brown, dry to damp, medium to coarse-grained, some pebbles and gravel	115.5	2.0		





# FIELD LOG OF BORING B-4

Sheet 1 of 2

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

Location: **44501 5th Street East**

Project No. **7111.23**

Date(s) Drilled: **2/20/2023** Logged By: **John Whitney**  
 Drilled By: **Choice Drilling, Inc.** Total Depth: **26 feet**  
 Rig Make/Model: **CME75** Hammer Type: **Automatic**  
 Drilling Method: **Hollow-stem Auger** Hammer Weight/Drop: **140 Lb./±30In.**  
 Hole Diameter: **8 inches** Surface Elevation: **N/A**

Comments: **Groundwater not encountered. Backfill not determined.**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SP	PLAY SAND: 2"				
						SM	SILTY SAND: Orange brown, moist, fine-grained sand				
3				19(Ring)		SM	SILTY SAND: Orange brown, moist, fine to medium-grained sand, some pebbles and gravel	103.2	10.3		SHEAR
5											
7				15(Ring)		ML	SANDY SILT: Orange brown, moist, fine-grained sand	104.1	14.4		
10				7(SPT)		SM	SILTY SAND: Orange brown, moist, fine to medium-grained sand		10.7		
15				29(Ring)		SP	SAND: Mottle orange and olive brown, damp, fine to coarse-grained sand, some pebbles	98.8	3.6		







# FIELD LOG OF PERCOLATION BORING B-P1

Sheet 1 of 1

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

Location: **44501 5th Street East**

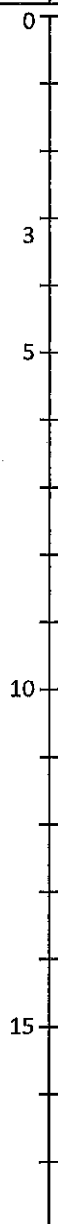
Project No. **7111.23**

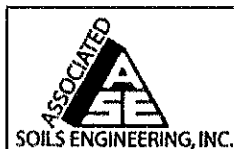
Date(s) Drilled: **2/20/2023** Logged By: **John Whitney**  
 Drilled By: **Choice Drilling, Inc.** Total Depth: **5 feet**  
 Rig Make/Model: **CME75** Hammer Type: **Automatic**  
 Drilling Method: **Hollow-stem Auger** Hammer Weight/Drop: **140 Lb./±30in.**  
 Hole Diameter: **8 inches** Surface Elevation: **N/A**

Comments: **Grounwater not encountered. Backfill not determined.**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SM	SILTY SAND: Light brown, moist, fine-grained sand				
3				8(SPT)			as above		14.7		PERCOLATION
5											

NOTE: 5 feet (5'0") slotted PVC pipe place in boring with annular area backfilled with pea gravel to surface. Two (2.0) inches of pea gravel placed at bottom of pipe. Percolation test performed after overnight presoaking.





# FIELD LOG OF PERCOLATION BORING B-P2

Sheet 1 of 1

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

Location: **44501 5th Street East**

Project No. **7111.23**

Date(s) Drilled: **2/20/2023** Logged By: **John Whitney**  
 Drilled By: **Choice Drilling, Inc.** Total Depth: **9 feet 9 inches**  
 Rig Make/Model: **CME75** Hammer Type: **Automatic**  
 Drilling Method: **Hollow-stem Auger** Hammer Weight/Drop: **140 Lb./±30In.**  
 Hole Diameter: **8 inches** Surface Elevation: **N/A**

Comments: **Grounwater not encountered. Backfill not determined.**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SP	SILTY SAND: Light brown, dry to damp, fine-grained sand				
3			24(Ring)				same as above	99.9	6.8		
5											
7			11(SPT)			SM	SAND: Olive brown, damp, very fine to medium-grained sand		5.0		
10											
15											

PERCOLATION

NOTE: 10 feet (upper 5'0" solid and lower 5'0" slotted) PVC pipe place in boring with annular area backfilled with pea gravel to surface. Two (2.0) inches of pea gravel placed at bottom of pipe. Percolation test performed after overnight presoaking.





# FIELD LOG OF PERCOLATION BORING B-P3

Sheet 1 of 1

Project: Proposed El Dorado Park Improvements - Lancaster, CA

Location: 44501 5th Street East

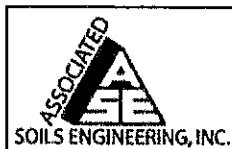
Project No. 7111.23

Date(s) Drilled: 2/20/2023  
Drilled By: Choice Drilling, Inc.  
Rig Make/Model: CME75  
Drilling Method: Hollow-stem Auger  
Hole Diameter: 8 inches  
Logged By: John Whitney  
Total Depth: 5 feet  
Hammer Type: Automatic  
Hammer Weight/Drop: 140 Lb./±30In.  
Surface Elevation: N/A

Comments: Grounwater not encountered. Backfill not determined.

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SM	SILTY SAND: Light brown, dry to damp, fine-grained sand				
3			25(Ring)					105.9	2.5		PERCOLATION
5											

NOTE: 5 feet (5'0") slotted PVC pipe place in boring with annular area backfilled with pea gravel to surface. Two (2.0) inches of pea gravel placed at bottom of pipe. Percolation test performed after overnight presoaking.



# FIELD LOG OF BORING B-2

Sheet 1 of 2

Project: **Proposed El Dorado Park Improvements - Lancaster, CA**

Location: **44501 5th Street East**

Project No. **7111.23**

Date(s) Drilled: **2/20/2023** Logged By: **John Whitney**  
 Drilled By: **Choice Drilling, Inc.** Total Depth: **26 feet**  
 Rig Make/Model: **CME75** Hammer Type: **Automatic**  
 Drilling Method: **Hollow-stem Auger** Hammer Weight/Drop: **140 Lb./±30In.**  
 Hole Diameter: **8 inches** Surface Elevation: **N/A**

Comments: **Grounwater not encountered. Backfill not determined.**

DEPTH (FT)	ELEVATION (MSL)	SAMPLE INTERVALS			LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		Bulk	Drive	TYPE "N" (Blows/ft.)							
0						SM	SILTY SAND: Orange brown, moist, fine-grained sand				
3			7(Ring)				same as above	101.8	11.3		
5											
7			19(Ring)				same as above	104.6	8.3		CONSOL
10			14(SPT)				same as above, damp		7.3		
15			27(Ring)			SM	SILTY SAND: Light orange brown, damp, fine-grained sand	107.1	6.1		

## Laboratory Tests

After samples were visually classified in the laboratory, a testing program aimed at generating sufficient data for subsequent evaluation was established and implemented.

- Moisture Content and Density Tests

The undisturbed soils retained within the rings of the Modified California barrel sampler were tested in the laboratory to determine in-place dry densities and moisture contents. The results are presented on the Field Logs of Borings (see attached "B" Plates).

- Consolidation and Direct Shear Tests

Consolidation (ASTM D 2435-11 Test Method) and direct shear (ASTM D 3080-11 Test Method) tests were performed on selected relatively undisturbed samples to determine the settlement characteristics and shear strength parameters of various soil samples, respectively. The results of these tests are shown graphically on the appended "C" and "D" Plates.

- Soil Corrosivity Tests

Tests of soluble sulfate and chloride contents were performed in accordance with California Test Methods 417 and 422, respectively, to assess the degree of corrosivity of the subgrade soils with regard to concrete and normal grade steel. Resistivity and pH-value tests were performed in accordance with the latest edition of ASTM G187-18 Test Method and California Test Method 643, respectively, to assess the degree of corrosivity of the subgrade soils with regard to ferrous metal piping. The test results are presented below.

Sample ID	Sulfate Content <sup>1</sup> (%)/ Exposure Category	Chloride Content <sup>2</sup> (ppm) / Exposure Category	Resistivity <sup>3</sup> (OHM-cm)/ Exposure Aggressiveness	Ph- Value <sup>3</sup>
B-1 @ 0'-5'	0.011/S0	17/C0	4510/Moderately Corrosive	8.31

- (1) California Test Method 417. (2) California Test Method 422. (3) ASTM G187-18 Test Method. (4) California Test Method 643.

- Maximum Dry Density/Optimum Moisture Content Test

A maximum density test was conducted in accordance with ASTM D1557-12, Method A, using 5 equal layers, 25 blows each layer, 10-pound hammer, 18 inch drop in a 1/30 cubic foot mold. The results are as follows:

Sample ID	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Material Classification
B-1 @ 0'-5'	134.5	8.5	SM
B-3 @ 0'-5'	131.5	9.5	SM



### Laboratory Tests – continued

- Expansion Test

An expansion test was performed on a soil sample to determine the swell characteristics. The expansion test was conducted in accordance with ASTM D4829-18 test procedures. The expansion sample was remolded to approximately 90 percent relative compaction at near optimum moisture content subjected to 144 pounds per square foot surcharge load and were saturated.

Sample ID	Molded Dry Density (pcf)	Molded Moisture Content (%)	% Saturation	Expansion Index (EI)	Expansion Classification
B-1 @ 0'-5'	122.8	7.79	56.6	0	Very Low

Plates C-1 through C-2

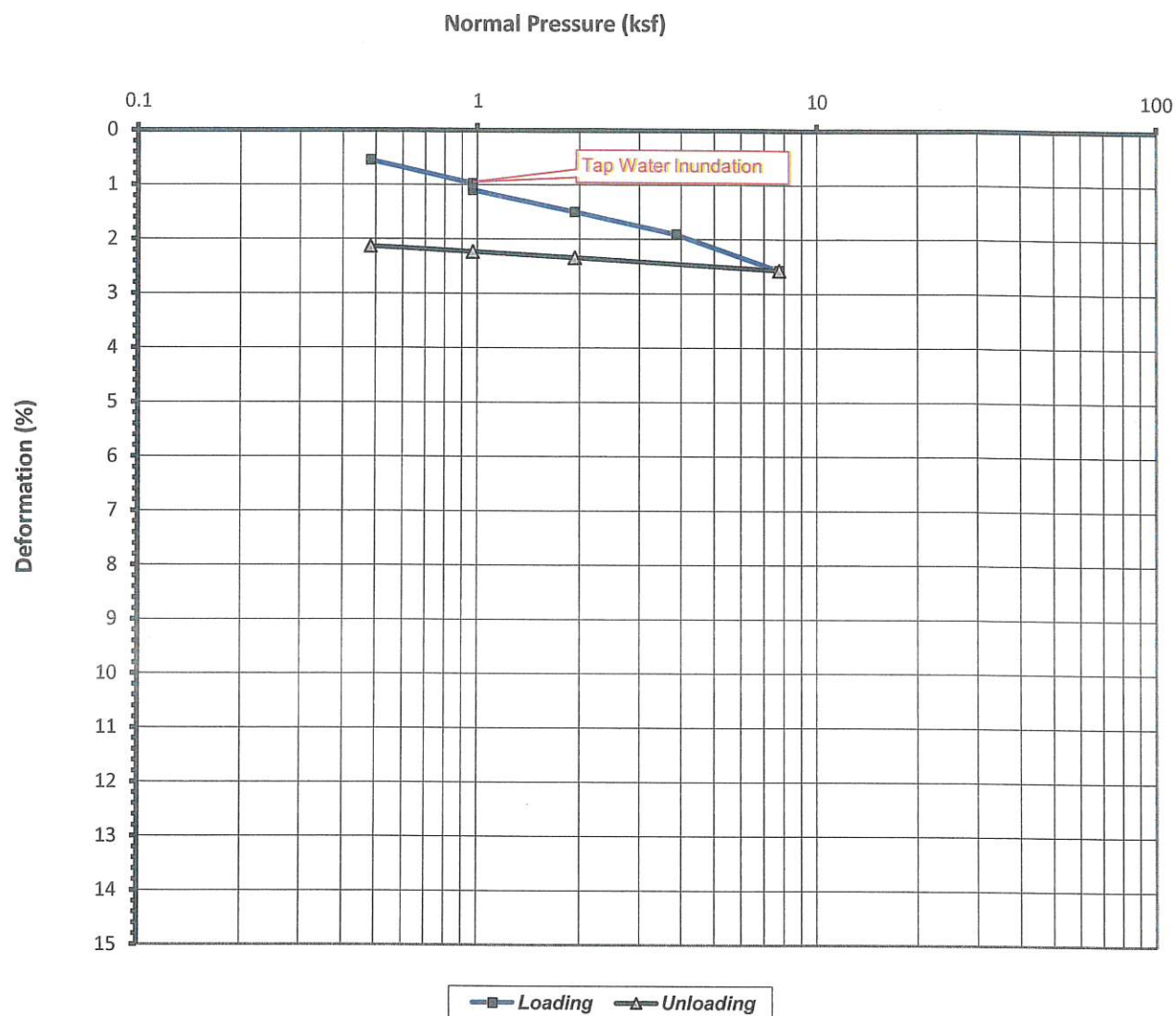
Uni-axial Consolidation Test Results

Plates D-1 through D-5

Direct Shear Test Results

Plates H-1 through H-3

Field Percolation Data Sheets



Sample Location	B-1 @ 3'	Dry Density (pcf)	109.7
Sample Type	Ring	Moisture (%)	4.1
Sample Description	Yellowish Brown Fine to Coarse Sand, trace Silt and Gravel		
Remark	Undisturbed sample		



**Associated Soils Engineering, Inc.**

2860 Walnut Avenue

Signal Hill, CA 90755

Tel (562) 426-7990 Fax (562) 426-1842

**Project:**

Proposed El Dorado Park Improvements  
44501 5th Street East, Lancaster, CA

**Plate**

Result of Uniaxial Consolidation/Swelling Test  
of On-Site Soil  
(ASTM D2435-11 Test Method)

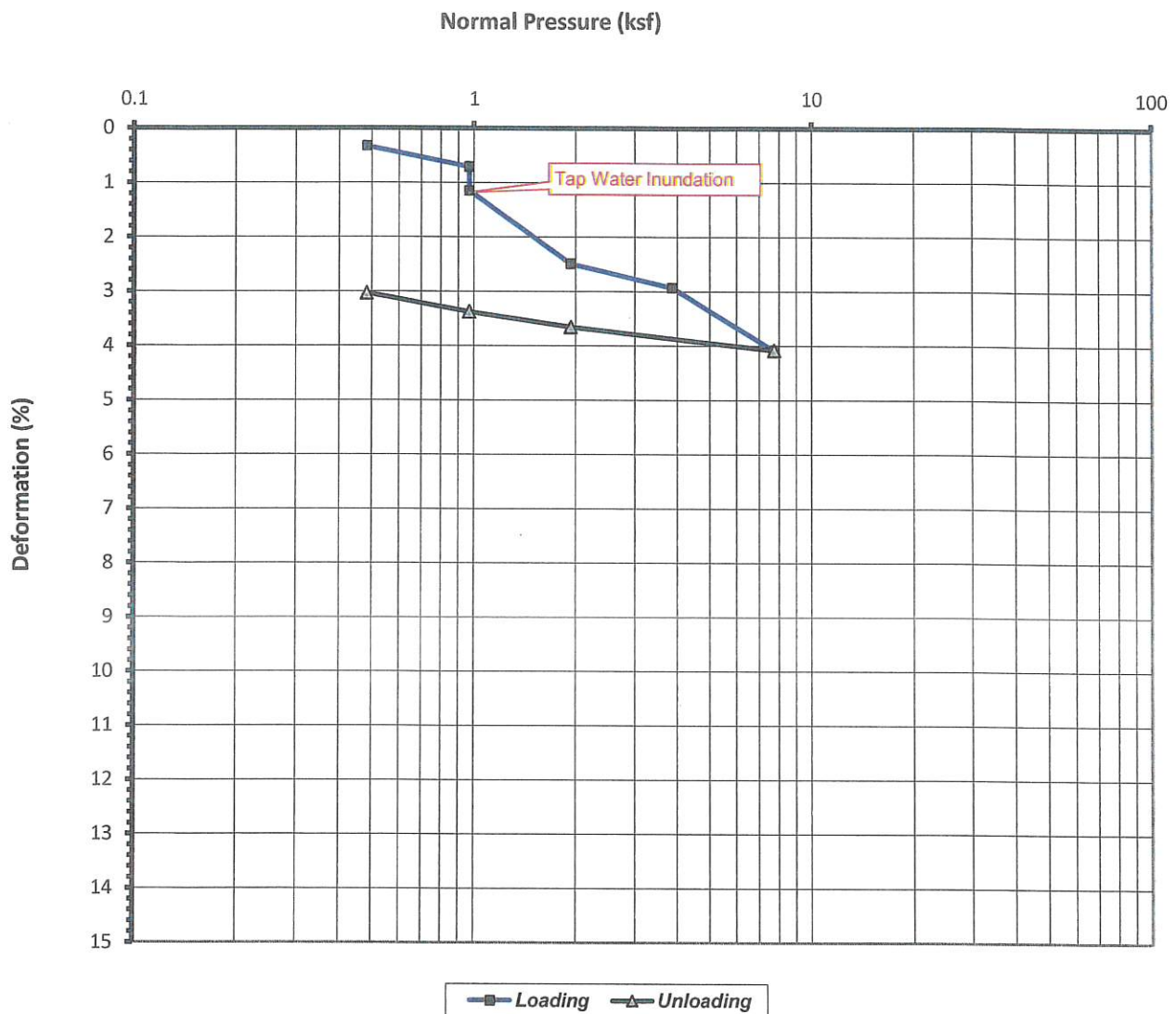
**C-1**

**Project No.:**

7111.23

**Date:**

April, 2023



Sample Location	B-2 @ 7'	Dry Density (pcf)	104.6
Sample Type	Ring	Moisture (%)	8.3
Sample Description	Yellowish Brown Fine Sandy Silt and Silty Fine Sand		
Remark	Undisturbed sample		



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**Project:**

Proposed El Dorado Park Improvements  
44501 5th Street East, Lancaster, CA

**Plate**

C-2

**Result of Uniaxial Consolidation/Swelling Test  
of On-Site Soil  
(ASTM D2435-11 Test Method)**

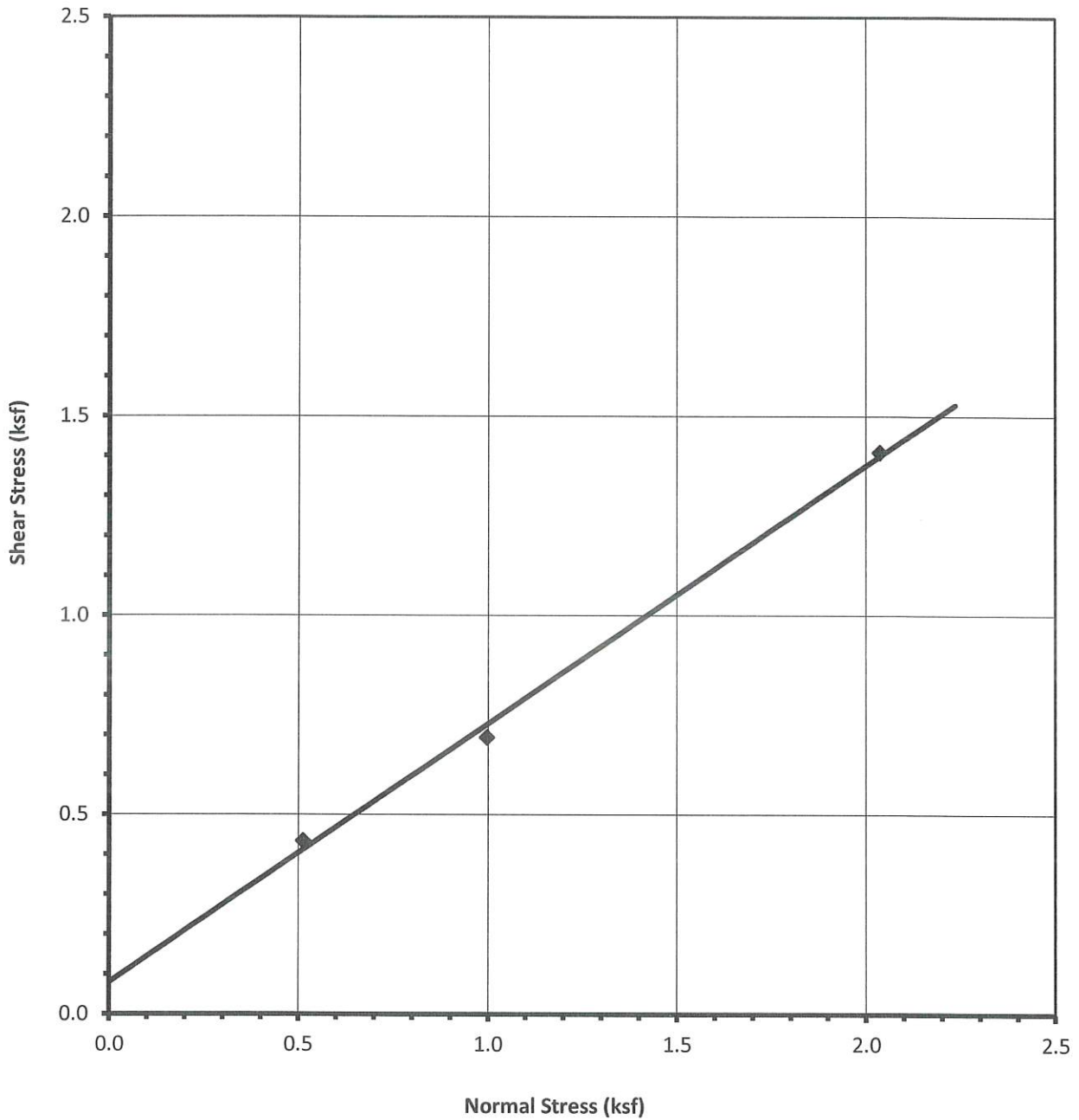
**Project No.:**

7111.23

**Date:**

April, 2023





—◆— Residual (Ultimate) Values

Sample  
Description

*B-1 @ 7'*  
*Orange brown Medium to coarse*  
*Sand*

Dry Density (pcf) | **107.1**  
Moisture Content (%) | **3.0**

$\phi$ -angle (degree)  
Cohesion (ksf)

**32.5**  
**0.075**

> Ultimate  
(Residual)



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Project:

**Proposed El Dorado Park Improvements**  
44501 5th Street East, Lancaster, CA

Plate  
D-1

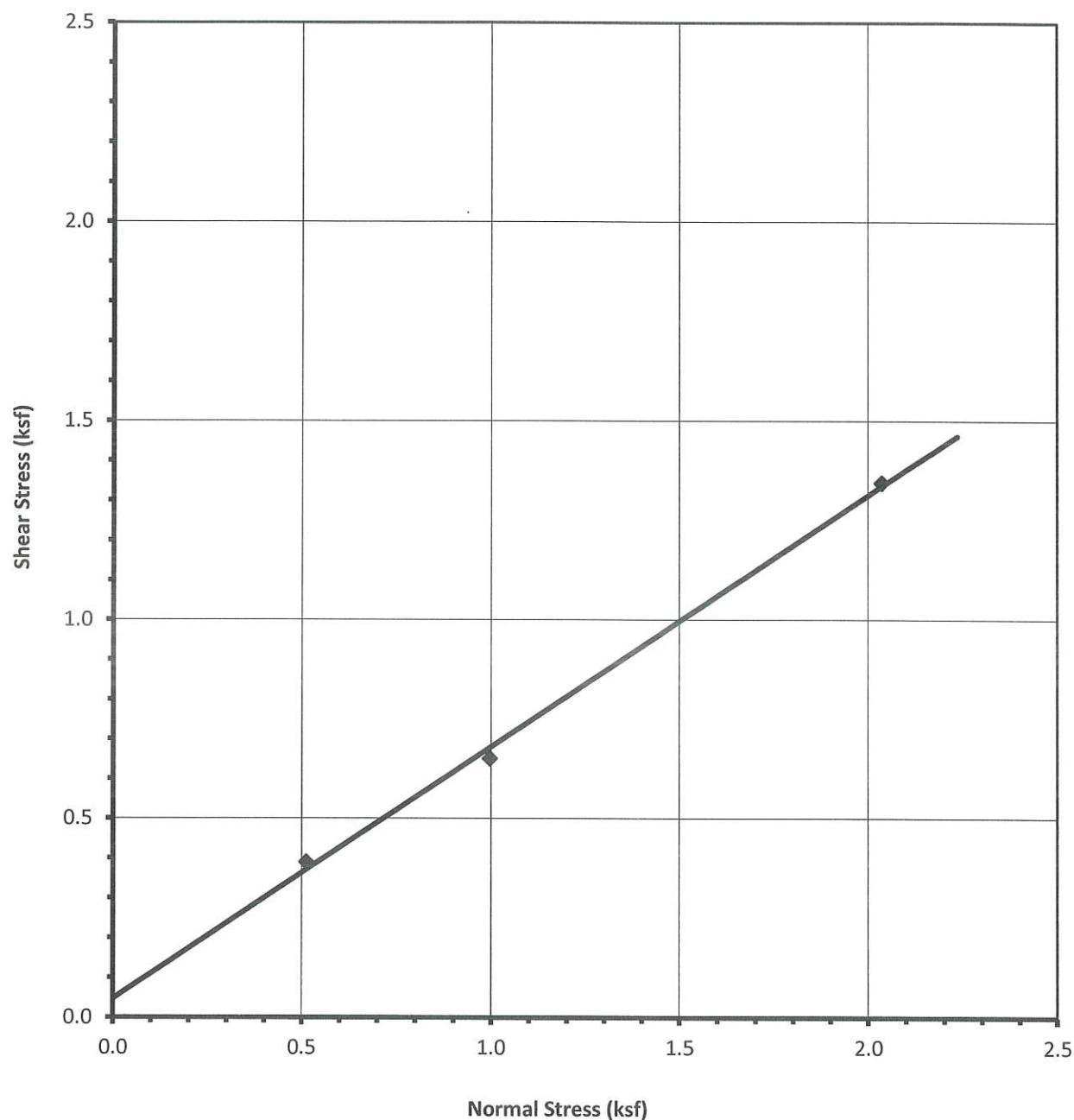
**Direct Shear Test Result**  
(ASTM D 3080-11 Test Method)

Project No.:

**7111.23**

Date:

**April, 2023**



—◆— Residual (Ultimate) Values

Sample  
Description

B-3 @ 3'  
Orange brown Silty Fine Sand

Dry Density (pcf) 110.2  
Moisture Content (%) 6.8

$\phi$ -angle (degree)  
Cohesion (ksf)

32.0  
0.045

> Ultimate  
(Residual)



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Signal Hill, CA 90755

Tel (562) 426-7990 Fax (562) 426-1842

Project:

Proposed El Dorado Park Improvements  
44501 5th Street East, Lancaster, CA

Plate  
D-2

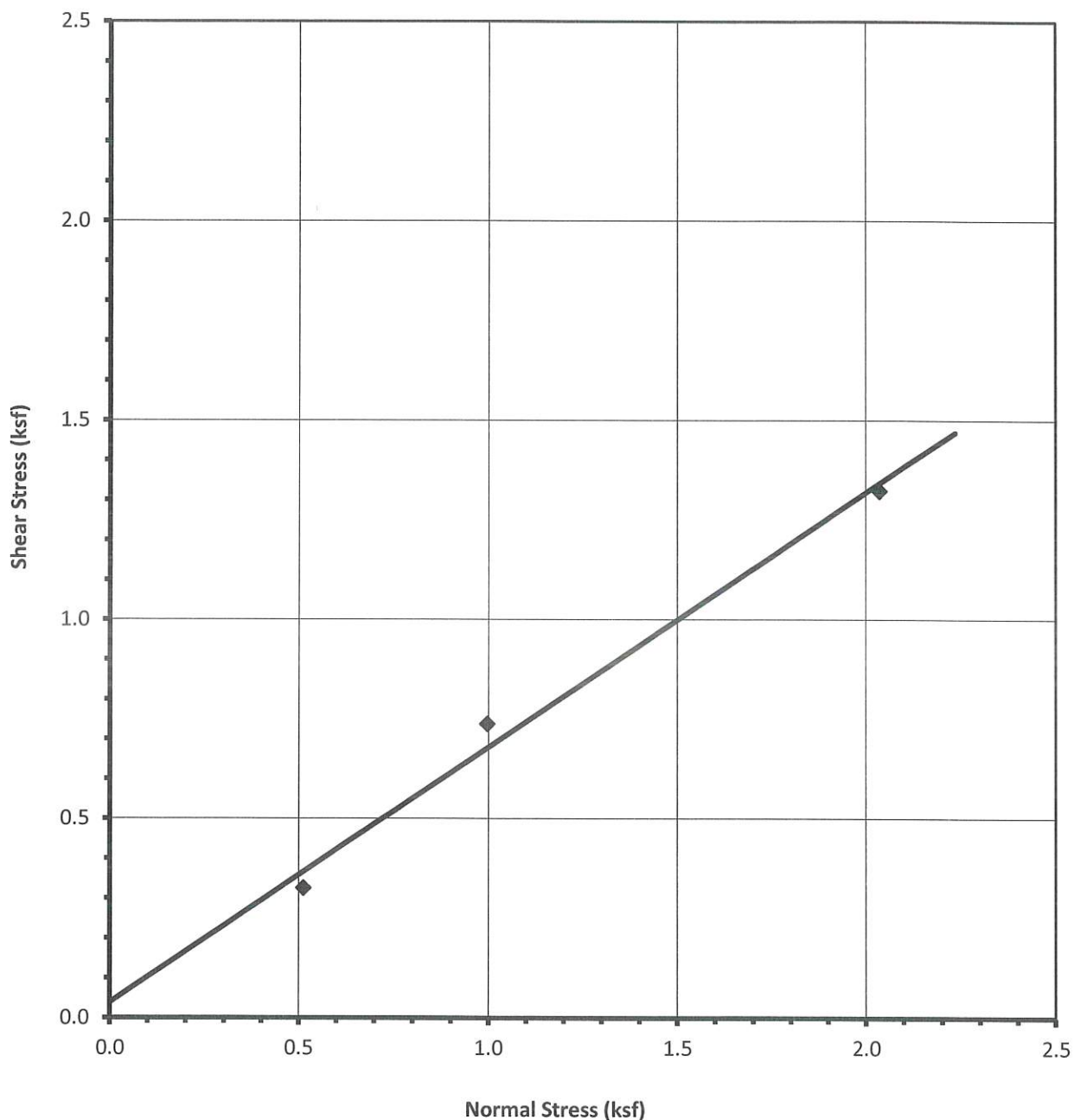
Direct Shear Test Result  
(ASTM D 3080-11 Test Method)

Project No.:

7111.23

Date:

April, 2023



—◆— Residual (Ultimate) Values

Sample  
Description

*B-4 @ 3'*  
*Orange Brown Silty Sand with some*  
*Fine Gravel*

Dry Density (pcf) **103.2**  
Moisture Content (%) **10.3**

$\phi$ -angle (degree)  
Cohesion (ksf)

**32.5**  
**0.035**

> Ultimate  
(Residual)



**Associated Soils Engineering, Inc.**

2860 Walnut Avenue  
Signal Hill, CA 90755

Tel (562) 426-7990 Fax (562) 426-1842

Project:

**Proposed El Dorado Park Improvements**  
44501 5th Street East, Lancaster, CA

Plate  
D-3

**Direct Shear Test Result**  
(ASTM D 3080-11 Test Method)

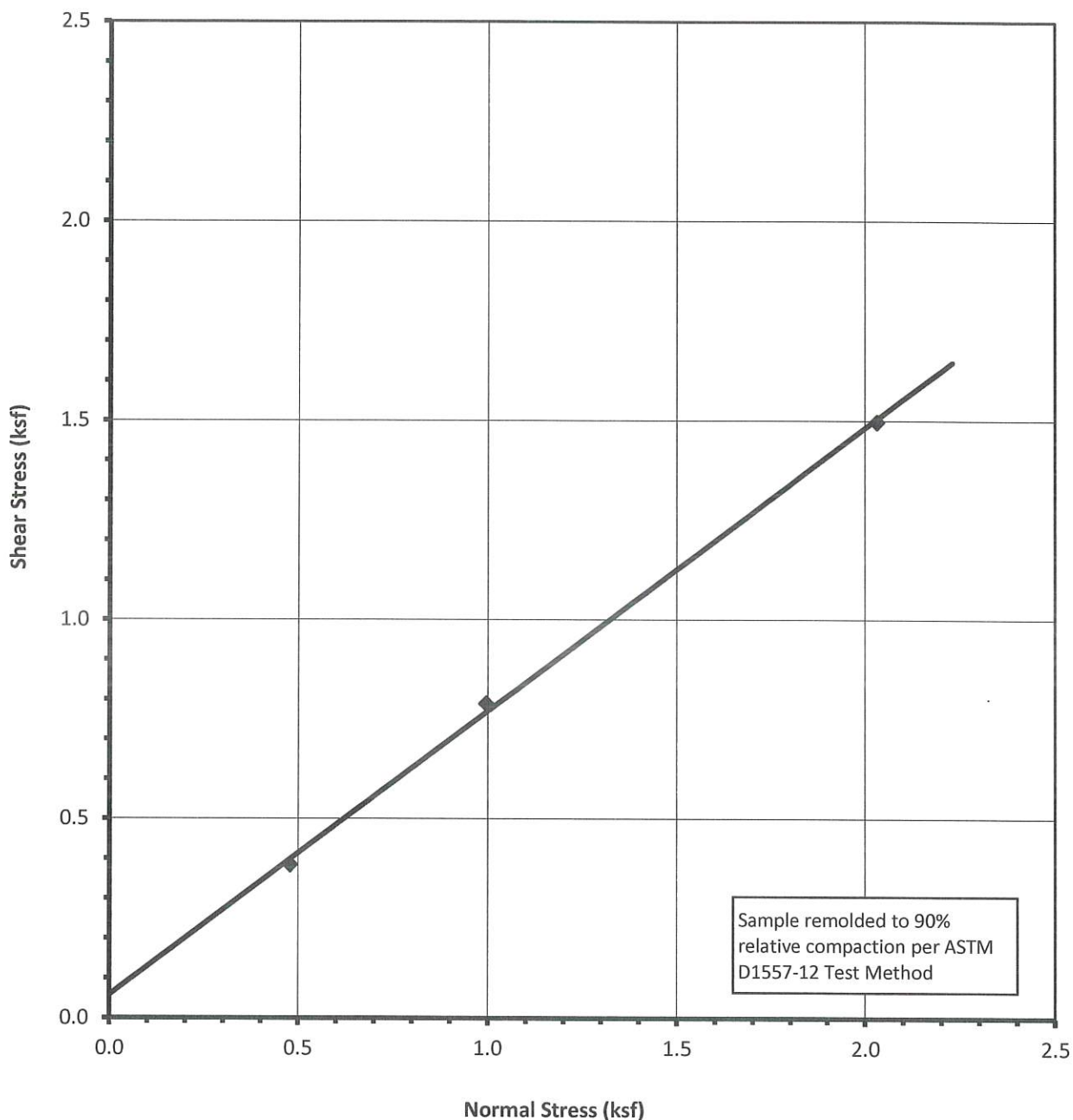
Project No.:

**7111.23**

Date:

**April, 2023**





—◆— Residual (Ultimate) Values

Sample  
Description

*B-1 @ 1'-5'*  
*Orange brown Silty Sand, trace clay  
and gravel*

Dry Density (pcf) **121.1**  
Moisture Content (%) **8.5**

$\phi$ -angle (degree)  
Cohesion (ksf)

**35.0**  
**0.055**

> Ultimate  
(Residual)



**Associated Soils Engineering, Inc.**

2860 Walnut Avenue  
Signal Hill, CA 90755

Tel (562) 426-7990 Fax (562) 426-1842

Project:

**Proposed El Dorado Park Improvements**  
44501 5th Street East, Lancaster, CA

Plate  
D-4

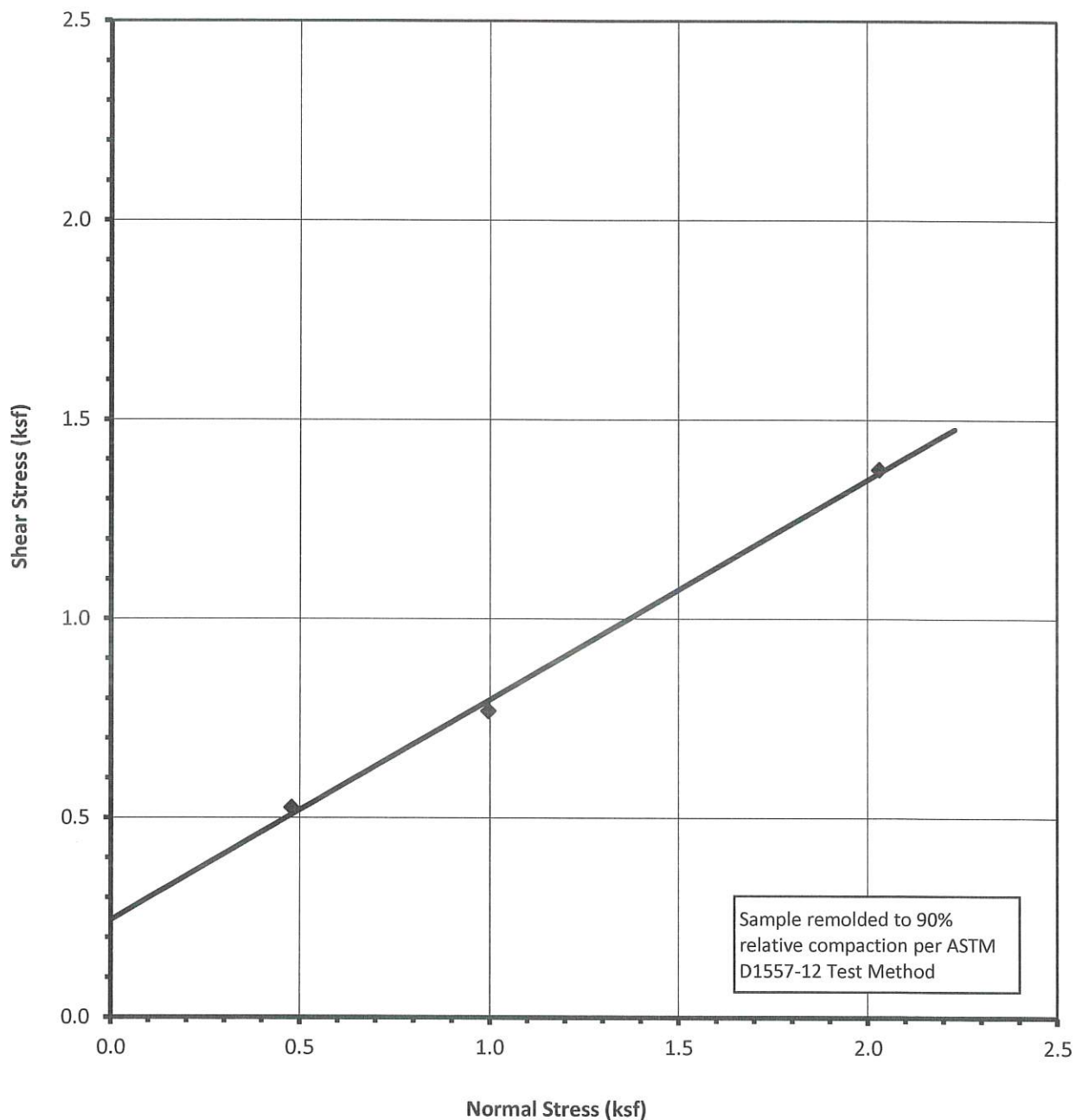
**Direct Shear Test Result**  
(ASTM D 3080-11 Test Method)

Project No.:

**7111.23**

Date:

**April, 2023**



—◆— Residual (Ultimate) Values

Sample  
Description

B-3 @ 0-5'  
Orange brown Silty Fine Sand

Dry Density (pcf) 118.4  
Moisture Content (%) 9.5

$\phi$ -angle (degree)  
Cohesion (ksf)

28.5  
0.240

> Ultimate  
(Residual)



Associated Soils Engineering, Inc.

2860 Walnut Avenue  
Signal Hill, CA 90755

Tel (562) 426-7990 Fax (562) 426-1842

Project:

Proposed El Dorado Park Improvements  
44501 5th Street East, Lancaster, CA

Plate  
D-5

Direct Shear Test Result  
(ASTM D 3080-11 Test Method)

Project No.:

7111.23

Date:

April, 2023

**PERCOLATION DATA SHEET**

Project: On-Site Storm Water Dispersal  
Proposed El Dorado Park Improvements  
44501 5<sup>th</sup> Street East, Lancaster, CA

Job No.: 7111.23

Test Hole No.: B-P1

Date Excavated: 2/20/2023

Depth of Test Hole: 5' 0"

Soil Classification: Silty Sand

2" Gravel on Bottom

Percolation Tested By: JC

Date: 2/21/2023

Presoak: √

**SANDY SOIL CRITERIA TEST**

<b><u>Trial No.</u></b>	<b><u>Time</u></b>	<b><u>Time Interval (Min.)</u></b>	<b><u>Initial Water Level (Inches)</u></b>	<b><u>Final Water Level (Inches)</u></b>	<b><u>Δ In Water Level (Inches)</u></b>
1	<u>10:15</u> <u>10:27</u>	12	-48.0	-60.0	12.0
2	<u>10:30</u> <u>10:43</u>	13	-48.0	-60.0	12.0

**USE ~~NORMAL~~ SANDY (CROSS ONE) SOIL CRITERIA**

<b><u>Time</u></b>	<b><u>Time Interval (Min.)</u></b>	<b><u>Total Elapsed Time (Min.)</u></b>	<b><u>Initial Water Level (Inches)</u></b>	<b><u>Final Water Level (Inches)</u></b>	<b><u>Δ In Water Level (Inches)</u></b>	<b><u>Percolation Rate (Min./Inches)</u></b>
<u>10:50</u> <u>11:00</u>	10	10	-12.0	-22.0	9.0	1.11
<u>11:00</u> <u>11:10</u>	10	20	-12.0	-19.0	7.0	1.43
<u>11:10</u> <u>11:20</u>	10	30	-12.0	-18.0	6.0	1.67
<u>11:20</u> <u>11:30</u>	10	40	-12.0	-17.0	5.0	2.00
<u>11:30</u> <u>11:40</u>	10	50	-12.0	-17.0	5.0	2.00
<u>11:40</u> <u>11:50</u>	10	60	-12.0	-16.75	4.75	2.11

**PLATE H-1**



**PERCOLATION DATA SHEET**

Project: On-Site Storm Water Dispersal  
Proposed El Dorado Park Improvements  
44501 5<sup>th</sup> Street East, Lancaster, CA

Job No.: 7109.23

Test Hole No.: B-P2

Date Excavated: 2/20/2023

Depth of Test Hole: 10' 0"

Soil Classification: Sand and Silty Sand

2" Gravel on Bottom

Percolation Tested By: JC

Date: 2/21/2023

Presoak: ✓

**SANDY SOIL CRITERIA TEST**

<u>Trial No.</u>	<u>Time</u>	<u>Time Interval (Min.)</u>	<u>Initial Water Level (Inches)</u>	<u>Final Water Level (Inches)</u>	<u>Δ In Water Level (Inches)</u>
1	<u>1:45</u> <u>1:51</u>	6	-108.0	-120.0	12.0
2	<u>1:51</u> <u>1:59</u>	8	-108.0	-120.0	12.0

**USE ~~NORMAL~~ SANDY (CROSS ONE) SOIL CRITERIA**

<u>Time</u>	<u>Time Interval (Min.)</u>	<u>Total Elapsed Time (Min.)</u>	<u>Initial Water Level (Inches)</u>	<u>Final Water Level (Inches)</u>	<u>Δ In Water Level (Inches)</u>	<u>Percolation Rate (Min./Inches)</u>
<u>2:05</u> 2:15	10	10	-60.0	-75.0	15.0	0.67
<u>2:15</u> 2:25	10	20	-60.0	-72.5	12.5	0.80
<u>2:03</u> 2:25	10	30	-60.0	-71.0	11.0	0.91
<u>2:25</u> 2:35	10	40	-60.0	-70.0	10.0	1.0
<u>2:35</u> 2:45	10	50	-60.0	-69.5	9.5	1.05
<u>2:45</u> 2:55	10	60	-60.0	-69.25	9.25	1.08

**PLATE H-2**

**PERCOLATION DATA SHEET**

Project: On-Site Storm Water Dispersal

Job No.: 7111.23

Proposed El Dorado Park Improvements

44501 5<sup>th</sup> Street East, Lancaster, CA

Test Hole No.: B-P3

Date Excavated: 2/20/2023

Depth of Test Hole: 5' 0"

Soil Classification: Silty Sand

2" Gravel on Bottom

Percolation Tested By: JC

Date: 2/21/2023

Presoak: ✓

**SANDY SOIL CRITERIA TEST**

<b><u>Trial No.</u></b>	<b><u>Time</u></b>	<b><u>Time Interval (Min.)</u></b>	<b><u>Initial Water Level (Inches)</u></b>	<b><u>Final Water Level (Inches)</u></b>	<b><u>Δ In Water Level (Inches)</u></b>
1	<u>8:30</u> <u>8:37</u>	7	-48.0	-60.0	12.0
2	<u>8:40</u> <u>8:49</u>	9	-48.0	-60.0	12.0

**USE ~~NORMAL~~ SANDY (CROSS ONE) SOIL CRITERIA**

<b><u>Time</u></b>	<b><u>Time Interval (Min.)</u></b>	<b><u>Total Elapsed Time (Min.)</u></b>	<b><u>Initial Water Level (Inches)</u></b>	<b><u>Final Water Level (Inches)</u></b>	<b><u>Δ In Water Level (Inches)</u></b>	<b><u>Percolation Rate (Min./Inches)</u></b>
<u>8:50</u> <u>9:00</u>	10	10	-12.0	-26.0	14.0	0.71
<u>9:00</u> <u>9:10</u>	10	20	-12.0	-24.5	12.5	0.8
<u>9:10</u> <u>9:20</u>	10	30	-12.0	-22.0	10.0	1.0
<u>9:20</u> <u>9:30</u>	10	40	-12.0	-20.0	8.0	1.25
<u>9:30</u> <u>9:40</u>	10	50	-12.0	-19.5	7.5	1.33
<u>9:40</u> <u>9:50</u>	10	60	-12.0	-19.75	7.75	1.29

**PLATE H-3**

## APPENDIX B - SITE FAULTING/SEISMICITY DATA

Plates I-1 and I-2

EQFAULT – Deterministic Estimation of Peak Acceleration from  
Digitized Faults



\*\*\*\*\*  
\*  
\* E Q F A U L T \*  
\*  
\* Version 3.00 \*  
\*  
\*\*\*\*\*

DETERMINISTIC ESTIMATION OF  
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 7111.23

DATE: 04-17-2023

JOB NAME: Proposed Improvements  
44501 5th Street East, Lancaster, CA  
CALCULATION NAME: EldoradoPark-Improvements

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\Cgsflte.dat

SITE COORDINATES:  
SITE LATITUDE: 34.6919  
SITE LONGITUDE: 118.1235

SEARCH RADIUS: 62 mi

ATTENUATION RELATION: 20) Sadigh et al. (1997) Horiz. - Soil  
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0  
DISTANCE MEASURE: clodis  
SCOND: 0  
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:  
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\Cgsflte.dat

MINIMUM DEPTH VALUE (km): 0.0

## EQFAULT SUMMARY-DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE		ESTIMATED MAX. EARTHQUAKE EVENT		
	DISTANCE		MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
	mi	(km)			
SAN ANDREAS - Whole M-1a	8.6	( 13.9)	8.0	0.361	IX
SAN ANDREAS - Cho-Moj M-1b-1	8.6	( 13.9)	7.8	0.343	IX
SAN ANDREAS - 1857 Rupture M-2a	8.6	( 13.9)	7.8	0.343	IX
SAN ANDREAS - Mojave M-1c-3	8.6	( 13.9)	7.4	0.305	IX
SAN ANDREAS - Carrizo M-1c-2	21.9	( 35.2)	7.4	0.155	VIII
SIERRA MADRE (San Fernando)	24.0	( 38.7)	6.7	0.118	VII
SIERRA MADRE	24.2	( 39.0)	7.2	0.161	VIII
SAN GABRIEL	26.6	( 42.8)	7.2	0.114	VII
VERDUGO	27.4	( 44.1)	6.9	0.117	VII
CLAMSHELL-SAWPIT	27.5	( 44.2)	6.5	0.088	VII
GARLOCK (West)	28.4	( 45.7)	7.3	0.113	VII
SANTA SUSANA	29.6	( 47.6)	6.7	0.093	VII
HOLSER	30.7	( 49.4)	6.5	0.077	VII
NORTHRIDGE (E. Oak Ridge)	33.0	( 53.1)	7.0	0.101	VII
RAYMOND	36.1	( 58.1)	6.5	0.062	VI
PUENTE HILLS BLIND THRUST	36.6	( 58.9)	7.1	0.096	VII
UPPER ELYSIAN PARK BLIND THRUST	37.5	( 60.4)	6.4	0.054	VI
CUCAMONGA	38.0	( 61.1)	6.9	0.079	VII
HOLLYWOOD	38.1	( 61.3)	6.4	0.053	VI
OAK RIDGE (Onshore)	39.6	( 63.8)	7.0	0.081	VII
SAN CAYETANO	40.3	( 64.9)	7.0	0.079	VII
SIMI-SANTA ROSA	40.8	( 65.7)	7.0	0.078	VII
GARLOCK (East)	41.3	( 66.4)	7.5	0.085	VII
LENWOOD-LOCKHART-OLD WOMAN SPRGS	41.8	( 67.2)	7.5	0.084	VII
HELENDAL - S. LOCKHARDT	42.5	( 68.4)	7.3	0.072	VI
WHITE WOLF	44.1	( 70.9)	7.3	0.088	VII
PLEITO THRUST	44.2	( 71.1)	7.0	0.070	VI
SANTA YNEZ (East)	45.0	( 72.4)	7.1	0.058	VI
SAN ANDREAS - SB-Coach. M-1b-2	45.1	( 72.6)	7.7	0.088	VII
SAN ANDREAS - SB-Coach. M-2b	45.1	( 72.6)	7.7	0.088	VII
SAN ANDREAS - San Bernardino M-1	45.1	( 72.6)	7.5	0.077	VII
SAN JOSE	45.1	( 72.6)	6.4	0.042	VI
CLEGHORN	45.7	( 73.6)	6.5	0.035	V
SANTA MONICA	46.2	( 74.3)	6.6	0.049	VI
SAN JACINTO-SAN BERNARDINO	46.7	( 75.1)	6.7	0.040	V
NEWPORT-INGLEWOOD (L.A.Basin)	47.3	( 76.1)	7.1	0.054	VI
WHITTIER	47.9	( 77.1)	6.8	0.042	VI
MALIBU COAST	50.0	( 80.4)	6.7	0.047	VI
CHINO-CENTRAL AVE. (Elsinore)	50.3	( 81.0)	6.7	0.047	VI
BIG PINE	51.0	( 82.0)	6.9	0.042	VI
ANACAPA-DUME	54.1	( 87.0)	7.5	0.079	VII
GRAVEL HILLS - HARPER LAKE	54.5	( 87.7)	7.1	0.045	VI
NORTH FRONTAL FAULT ZONE (West)	55.0	( 88.5)	7.2	0.062	VI
PALOS VERDES	57.5	( 92.6)	7.3	0.049	VI
So. SIERRA NEVADA	58.0	( 93.3)	7.3	0.062	VI
M.RIDGE-ARROYO PARIDA-SANTA ANA	61.1	( 98.4)	7.2	0.054	VI

\*\*\*\*\*

46 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.THE SAN ANDREAS - Whole M-1a FAULT IS CLOSEST TO THE SITE. IT IS ABOUT 8.6 MILES (13.9 km) AWAY. LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.3610 g

### **APPENDIX C - LIST OF REFERENCES**

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16. Corrosion Guidelines, Version 2.0, November 2012, Published by California Department of Transportation (Caltrans), 44p.
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18. California Geologic Survey, 2011, Preliminary Geologic Map of the Lancaster East 7.5' Quadrangle, Los Angeles County, California, a Digital Database, Version 1.0.



## APPENDIX B

### ASBESTOS AND LEAD CONTAINING MATERIALS RENOVATION SURVEY REPORT

# TITAN

ENVIRONMENTAL  
SOLUTIONS

## ASBESTOS AND LEAD-CONTAINING MATERIALS RENOVATION SURVEY REPORT

### *SUBJECT PROPERTY:*



**EL DORADO PARK RENOVATION  
44501 5<sup>TH</sup> STREET,  
LANCASTER, CALIFORNIA 93535**

### *PREPARED FOR:*

**CITY OF LANCASTER  
ATTN: VICTOR GUTIERREZ  
44933 FERN AVENUE,  
LANCASTER, CALIFORNIA 93534**

### *PREPARED BY:*

ENVIRONMENTAL  
SOLUTIONS



**TITAN ENVIRONMENTAL SOLUTIONS, INC.  
1521 EAST ORANGETHORPE AVENUE, SUITE B  
FULLERTON, CALIFORNIA 92831**

**PROJECT No. 118291-AS, XRF**

**SURVEY DATE: DECEMBER 18, 2023**

**RETURN DATE: JANUARY 3, 2024**

**REPORT DATE: JANUARY 5, 2024**

Northern California  
1901 Harrison Street, Suite 1100  
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## 1.0 EXECUTIVE SUMMARY

Titan Environmental Solutions, Inc. (TES) was retained by the City of Lancaster, Senior Coordinator, Victor Gutierrez (Client) to perform an asbestos and lead-containing materials renovation survey of the property located at 44501 5<sup>th</sup> Street, Lancaster, California 93535 (Subject Property).

The survey included all accessible building areas, including the interior, exterior and roofing materials, that are scheduled for disturbance within the project area at the Subject Property. The asbestos and lead-containing materials survey was conducted in accordance with a mutually agreed upon proposal and scope of work.

The asbestos and lead-containing materials survey was conducted on December 18<sup>th</sup>, 2023, by Christopher Kim, California Division of Occupational Safety and Health (DOSH/Cal-OSHA) Certified Site Surveillance Technician (CSST No. 19-6676) and State of California Department of Public Health (CDPH) Certified Lead-Related Construction (LRC) Sampling Technician (LRCST No. LRC-00007403), Thai Chu, CDPH Certified LRC Sampling Technician (LRCST No. LRC-00011860) and on January 3<sup>rd</sup>, 2024, by Jared San Antonio, California Division of Occupational Safety and Health (DOSH/Cal-OSHA) Certified Site Surveillance Technician (CSST No. 12-4888) and State of California Department of Public Health (CDPH) Certified Lead-Related Construction (LRC) Sampling Technician (LRCST No. LRC-00007724). The survey was performed under the general direction of Robert Menald, DOSH/Cal-OSHA Certified Asbestos Consultant (CAC No. 08-4323) and CDPH Certified LRC Inspector/Assessor (LRCIA No. LRC-00005260). The report was reviewed by Ibrahim M. Sobeih, DOSH/Cal-OSHA Certified Asbestos Consultant (CAC No. 06-4078), CDPH Certified LRC Inspector/Assessor (LRCIA No. LRC-00011308) and Certified Industrial Hygienist (CIH) in the Comprehensive Practice by the Board for Global EHS Credentialing (BGC Certificate No. 5628CP).

The following summarizes the sampling and findings:

### **Asbestos**

- The asbestos survey was performed in accordance with the Environmental Protection Agency's (EPA's) National Emissions Standard for Hazardous Air Pollutants (NESHAP) asbestos regulations protocol for sample collection for demolition/renovation surveys and South Coast Air Quality Management District (SCAQMD) Rule 1403, and sample analysis in accordance with EPA's "Method for the Determination of Asbestos in Bulk Building Materials" (EPA 600-R-93-116).
- TES collected a total of forty-three (43) bulk samples of suspect Asbestos Containing Materials / Asbestos Containing Construction Materials (ACMs/ACCMs) representing thirteen (13) identified homogenous areas in the survey area of the Subject Property, which were analyzed for asbestos content via Polarized Light Microscopy (PLM) visual estimation method.





- Material quantities provided in this report are for information purposes exclusively, and are not intended to be the basis of a contractor's bid for removal or abatement. Contractors are required to field verify materials and quantities for the purposes of bidding on contracted work.
- Asbestos was detected or assumed in the following materials in the survey area.

Table 1-1: Identified ACM										
HA No.	Sample No.	Sample Locations	Material Description	Class	Material Location(s)*	Friable/ Non-Friable	Material Condition (G, D, SD)	Estimated Quantity*	Asbestos Analytical Results	SCAQMD Cat.
09	1218-09-27 1218-09-28 1218-09-29	Center Roof - Roof Penetration N. Roof - Roof Penetration S. Roof - Roof Penetration	Black Roof Penetration Mastic	Misc.	Throughout Roof Penetrations	NF	G	50 SF	3% Chrysotile	Class I ACM
<b>Legend:</b> HA = Homogenous Area N = North, E = East, W = West, S = South, SF = Square Feet, LF = Linear Feet, ND = None Detected Classification (Class.): Misc. = Miscellaneous, Surf. = Surfacing, TSI = Thermal System Insulation Condition: G = Good, D = Damaged, SD = Significantly Damaged Categories (Cat.): • Cal/OSHA: ACCM = Asbestos Containing Construction Materials, ACM = Asbestos Containing Materials, • NESHAP: Cat I = Category I Non-friable ACM, Cat II = Category II Non-friable ACM, RACM = Regulated Asbestos Containing Material • SCAQMD: Class I = Class I Non-friable ACM, Class II = Class II Non-friable ACM, FACM = Friable Asbestos Containing Material *Locations and quantities are estimates based on accessible materials located in the survey area only. Additional locations and quantities may be present at the Subject Property. **In accordance to 40 CFR 61.141 and US EPA Applicability Determination Index Control Number: C112, if the amount by visual estimation appears to be less than 10 percent, the owner or operator may (1) assume the amount to be greater than 1 percent and treat the materials asbestos-containing material, or (2) require verification of the amount by point counting. If a result obtained by point count is different from a result obtained by visual estimation, the point count result will be used. Please note the Certified Asbestos Consultant will assume any material that is <1% analyzed via PLM and not verified by point count as an Asbestos Containing Material (ACM).										

## Lead

- TES performed X-Ray Fluorescence (XRF) Analyzer testing of one-hundred (100) surfaces painted/coated with suspect lead-based paints and/or lead-containing materials (LBPs/LCMs) in the survey area of the Subject Property.
- For the purpose of this lead survey, any material containing any detectable level of lead is subject to OSHA's Lead Exposure in Construction Rule Title 29, Code of Federal Regulations, Part 1926, Section 62 (29 CFR 1926.62) and Title 8, California Code of Regulations, Section 1532.1 (8 CCR 1532.1).
- LCMs/LBPs were identified in the following tested surfaces in the survey area.



Table 1-2: Identified LCMs/LBPs

Reading	Room / Location*	Side <sup>1</sup>	Structure	Condition <sup>2</sup>	Substrate	Color	Lead Concentration (mg/cm <sup>2</sup> )	Classification <sup>3</sup>
48	Men's Restroom	Center	Urinal Wall	Ceramic	I	White	8.9	LBP
65	Women's Restroom	S	Door	Wood	I	Tan	0.2	LCM

Legend:

<sup>1</sup>Side: N = North, E = East, W = West, S = South

<sup>2</sup>Paint Condition: I = Intact, D = Deteriorated

<sup>3</sup>Classification:

- BDL = Below the XRF's detection level; <0.1 mg/cm<sup>2</sup>.

- LCM = Lead Containing Materials (LCM); ≥0.1 mg/cm<sup>2</sup>

- LBP = Lead-Based Paints (LBP); ≥0.7 mg/cm<sup>2</sup>.

- LA County Department of Health Services (DHS), LA County Code Title 11, Health & Safety, Chapter 11.28, section 11.28.010 defines LBP as paint or other surfacing coating which contains lead or its compounds in excess of seven-tenths of one milligram per square centimeter (0.7 mg/cm<sup>2</sup>).

\*Locations are estimates based on accessible materials located in the survey area only. Additional locations may be present at the Subject Property.

## ASBESTOS-CONTAINING BUILDING MATERIALS

TES has the following recommendations based on the findings of the asbestos-containing building materials survey:

- The asbestos survey was performed in accordance with the EPA's NESHAP asbestos regulations protocol for sample collection for demolition/renovation surveys and SCAQMD Rule 1403 and sample analysis in accordance with EPA's "Method for the Determination of Asbestos in Bulk Building Materials" (EPA 600-R-93-116).
- A California licensed and DOSH/Cal-OSHA registered asbestos abatement contractor should be contracted to remove/abate ACMs/ACCMs and materials containing asbestos that are damaged or will be disturbed.
- A DOSH/Cal-OSHA Certified Asbestos Consultant should be contracted to conduct monitoring and clearance of any removal/abatement of ACMs/ACCMs and materials containing asbestos.
- Any materials that have not been identified in this report should be considered suspect ACMs/ACCMs and handled as ACM unless sampled by a DOSH/Cal-OSHA Certified Asbestos Consultant proven to be non-ACM by laboratory analysis.
- Material quantities provided in this report are for information purposes exclusively, and are not intended to be the basis of a contractor's bid for removal or abatement. Contractors are required to field verify materials and quantities for the purposes of bidding on contracted work.
- All asbestos activities must be performed in accordance with all applicable federal, state and local regulations including, but not limited to those summarized in this report.



## **LEAD-BASED PAINTS / LEAD-CONTAINING MATERIALS**

TES has the following recommendations based on the findings of the lead in paint survey:

- In accordance with 29 CFR 1926.62 and 8 CCR 1532.1, any disturbance of LCM and/or LBP should be performed by lead hazard communication trained workers using lead safe work practices that do not result in exposures above the Action Level (AL) of 30 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) and/or Permissible Exposure Limit (PEL) of 50  $\mu\text{g}/\text{m}^3$ .
- In accordance with Resource Conservation and Recovery Act (RCRA) Title 40, Code of Federal Regulations, Part 261 (40 CFR 261) and California Department of Toxic Substance Control (DTSC) requirements, all lead containing wastes should be sampled and analyzed for total and leachable lead concentrations and disposed of accordingly based on the waste characterization analytical results.
- Any paints/coatings that have not been identified in this report should be considered presumed LBP and handled as LBP unless sampled by a CDPH Certified Lead Inspector/Assessor and proven to be non-LBP by laboratory analysis.
- All lead activities must be performed in accordance with all applicable federal, state and local regulations, including but not limited to those summarized in this report.



## **2.0 BUILDING / LOCATION DESCRIPTION**

The Subject Property is a single-story wood wood-framed public park and recreation building. The structure's construction cofeatures concrete exterior walls finished with stucco materials and is supported by a concrete slab foundation. The interior finishes consisted of common plaster and concrete wall materials materials. Ceilings are covered with ceiling paneling, while the restrooms feature hard lid ceilings. The floor finishes consisted of vinyl floor tiles and ceramic tiles witin the Craft's Room and Office. The floors within the Men's and Women's Restroom are concrete coated with an epoxy material.

The roof of the structure is finished with a Built-Up Roof (BUR) system.

## **3.0 SURVEY PURPOSE AND SCOPE**

### **3.1 SURVEY PURPOSE**

- Collect bulk samples of suspect ACMs for demolition/renovation surveys in accordance with the NESHAP and SCAQMD Rule 1403 asbestos regulations protocol for sample collection for demolition/renovation surveys and submit to an accredited laboratory for analysis. Analyze asbestos bulk samples using PLM visual estimation in accordance with EPA's July 1993 method (EPA 600/R-93/116) for the determination of asbestos in bulk building materials;
- Conduct a survey for LBPs/LCMs using an XRF paint analyzer to screen materials suspected of being coated with LBPs and/or LCMs; and
- Submit written report including analytical results, regulatory requirements, conclusions and recommendations.

The survey did not include destructive investigation methods to identify or sample concealed materials (i.e. within wall cavities, pipe chases, encased in concrete, etc.) nor did it include dismantling equipment to identify or sample inaccessible materials (i.e. gaskets, packings, etc.).

## **4.0 ASBESTOS SAMPLING METHODOLOGY AND REGULATIONS**

### **4.1 ASBESTOS SURVEY AND ANALYTICAL LABORATORY**

The asbestos survey was conducted in accordance with NESHAP pre-demolition standards. The asbestos survey consisted of two (2) primary field activities [(1) visual inspection of the survey area and (2) representative bulk sampling of suspect asbestos containing materials], laboratory sample analysis, and preparation of a survey report.

#### ***Asbestos Inspection***

The visual inspection included the following activities: (1) identifying homogenous areas of suspect ACM, (2) determining friability and classification [surfacing = material that is spray or trowel applied,





thermal system insulation (TSI) = material used to prevent heat gain/loss or condensation, or miscellaneous = material that is not surfacing or TSI] of each homogenous area of suspect ACM, (3) assessing the condition of each homogenous area of suspect ACM, and (4) quantifying each homogenous area of suspect ACM.

Visual inspection and physical handling are performed for all suspect materials to ensure proper friability classification, condition and potential damage - materials are assessed for any damage by impact, water, aging, deterioration, or delaminating from their substrata.

- **Good Condition:** Material with no visible damage, deterioration, or showing only very limited damage or deterioration.
- **Damaged:** The surface is crumbling, blistered, water stained, gouged, marred or otherwise abraded over less than one-tenth of the surface if the damage is evenly distributed; or less than one quarter if the damage is localized. Accumulation of powder, dust, or debris similar in appearance to the suspect material on surfaces beneath the material can be used as confirmatory evidence.
- **Significantly Damaged:** The surface is crumbling or blistered over at least one-tenth of the surface if the damage is evenly distributed or at least one quarter if the damage is localized; and water stains, gouges or mars over at least one-tenth of the surface if the damage is evenly distributed or at least one quarter if the damage is localized. Accumulation of powder, dust, or debris similar in appearance to the suspect material on surfaces beneath the material can be used as confirmatory evidence.

### ***Asbestos Sampling***

The bulk sampling included the following activities: (1) developing a representative sampling plan for each homogenous area of suspect ACM based on the classification and estimated quantity, and (2) collecting representative bulk samples of each homogenous area of suspect ACM in the survey area at the Subject Property as identified by the Client. Efforts are made to obtain the samples from inconspicuous areas. Each sample is placed in a plastic or metal container. The container is sealed, labeled and placed in a larger storage bag.

Throughout the process, care is taken to prevent cross-contamination of the collected samples. Sampling equipment is cleaned after each sample is obtained. In addition, sample containers are placed directly beneath each sample location, when feasible, to collect any materials which may become dislodged during the sampling process. Any debris generated by the sampling is cleaned by wet-cleaning methods.

Samples are documented by entering the sample data on a bulk log, including a description of the material, sample number, location, condition, accessibility, friability, potential for damage, and estimated quantity. Typically, the sample location is marked on an 8-1/2 x 11-inch floor plan (not to scale).



### ***Asbestos Sample Analysis***

Upon completion of the bulk sampling activities, the samples were submitted to an accredited laboratory by the National Institute for Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP), under proper Chain-of-Custody (COC) documentation. Bulk sample analyses was conducted by Polarized Light Microscopy (PLM) with dispersion staining as described in the "Method for the Determination of Asbestos in Bulk Building Materials," Method EPA-600/R-93/116 (July 1993, Part 1). A sample is immersed in a solution of known refractive index and subjected to illumination by polarized light.

TES collected forty-three (43) bulk samples of suspect ACM/ACCMs representing thirteen (13) homogenous areas from the survey area of the Subject Property, which were analyzed for asbestos content via Polarized Light Microscopy (PLM) visual estimation, of which five (5) samples representing one (1) homogeneous area were collected on January 3<sup>rd</sup>, 2024 and analyzed by SGS Forensic Laboratory, located in Carson, California and and thirty-eight (38) samples representing twelve (12) homogeneous areas were collected on December 18<sup>th</sup>, 2023 and analyzed by Eurofins EPK Built Environment Testing, LLC. Located in Glendale, California.

SGS Forensic Laboratory and Eurofins EPK Built Environment Testing, LLC are accredited by the National Institute for Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab Code 101459-1 and 200945-0) for asbestos fiber analysis.

## **4.2 ASBESTOS REGULATORY DEFINITIONS AND STANDARDS**

### ***Asbestos Regulatory Definitions***

The Environmental Protection Agency (EPA) defines asbestos-containing material (ACM) as follows:

- **ACM** is defined by EPA as any material containing more than one percent (>1%) asbestos as determined using the method specified in Section 1, Appendix E of 40 CFR Part 763 Subpart E, Polarized Light Microscopy (PLM). In order to verify a material with detected concentrations of asbestos is not an ACM, the EPA requires PLM point count analysis to confirm the asbestos concentration is <1.0%.
- **Friable ACM** as defined by the EPA, means material containing more than one percent (>1%) as determined by PLM that when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously non-friable material after such previously non-friable material becomes damaged to the extent that when dry it may be crumbled, pulverized, or reduced to powder by hand pressure.
- **Non-friable ACM** as defined by the EPA, means material containing more than one percent (>1%) as determined by PLM that when dry, may NOT be crumbled, pulverized, or reduced to powder by hand pressure. NESHAP further defines two (2) categories of non-friable ACM:



- **Category I (Cat I) - Category I Non-friable ACM** is any asbestos-containing packing, gasket, resilient floor covering, mastic or asphalt roofing product which contains more than one percent (>1%) asbestos as determined using PLM according to the method specified in Appendix E, Subpart E, 40 CFR Part 763.
- **Category II (Cat II) - Category II Non-friable ACM** is any material, excluding Category I non-friable ACM, containing more than one percent (>1%) asbestos as determined using PLM according to the method specified in Appendix E, Subpart E, 40 CFR Part 763 that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
- **Regulated Asbestos-Containing Material (RACM)** is defined by NESHAP as Friable ACM, Category I Non-friable ACM that has become friable, Category I Non-friable ACM that will be or has been subjected to sanding, grinding, cutting or abrading, or Category II Non-friable ACM that has a high probability of becoming or has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

#### ***South Coast Air Quality Management District (SCAQMD)***

- **Class I Non-friable ACM** is defined by South Coast Air Quality Management District (SCAQMD) as material containing more than one percent (>1%) asbestos as determined by PLM, and that, when dry, can be broken, crumbled, pulverized, or reduced to powder in the course of demolition or renovation activities. Actions which may cause material to be broken, crumbled, pulverized, or reduced to powder include physical wear and disturbance by mechanical force, such as, but not limited to, sanding, sandblasting, cutting or abrading, improper handling or removal or leaching of matrix binders. Class I non-friable asbestos-containing material includes, but is not limited to, fractured or crushed asbestos cement products, transite materials, mastic, roofing felts, roofing tiles, cement water pipes and resilient floor covering.
- **Class II Non-friable ACM** is defined by South Coast and Antelope Valley Air Quality Management Districts as all other material containing more than one percent (>1%) asbestos as determined by PLM, that is neither friable nor Class I non-friable.
- **Friable Asbestos-Containing Material (FACM)** is defined by South Coast Air Quality Management District (SCAQMD) in Rule 1403 as a material containing more than one percent (1%) asbestos, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

**Federal Occupational Safety and Health Administration (OSHA) and the California Division of Occupational Safety and Health (DOSH/Cal-OSHA)** Classes of Asbestos Work as codified in 29 CFR 1926.1101 and 8 CCR 1529, respectively:



- **Class I** Asbestos work means activities involving the removal of TSI and surfacing ACM and PACM.
- **Class II** Asbestos work means activities involving the removal of ACM which is no thermal system insulation or surfacing materials. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics / adhesives.
- **Class III** Asbestos work means repair and maintenance operations, where "ACM", including TSI and surfacing ACM and PACM, is likely to be disturbed.
- **Class IV** Asbestos work means maintenance and custodial activities during which employees contact, but do not disturb, ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II, and III activities.

The Federal Occupational Safety and Health Administration (OSHA) and the California Division of Occupational Safety and Health (DOSH/Cal-OSHA) use the following definitions for materials containing asbestos:

- **ACM** is defined by OSHA and DOSH/Cal-OSHA as any material containing more than one percent (>1%) asbestos.
- **Asbestos-containing construction material (ACCM)** is defined by DOSH/Cal-OSHA as any manufactured construction material containing greater than one tenth of one percent (>0.1%) asbestos.
- **Material Containing Asbestos** OSHA and DOSH/Cal-OSHA regulate materials containing any detectable concentrations of asbestos.

#### ***Asbestos Regulatory Standards Summary***

NESHAP, OSHA, DOSH/Cal-OSHA, the California Department of Toxic Substance Control (DTSC) and local air quality/pollution control districts regulate the removal, disturbance and disposal of asbestos in California. The following is a brief list of these, not all, applicable regulatory standards:

- **Cat I and II/Class I and II Non-Friable ACM (>1% asbestos):**
  - NESHAP and local air quality/pollution control districts require the abatement/removal of ACM, both friable and non-friable in California, prior to renovation or demolition activities which would disturb them. The abatement/removal must be performed in accordance with the local air quality/pollution control district regulatory standard, including containment and notification as applicable.
  - DOSH/Cal-OSHA requires abatement/removal of ACM to be performed by a California licensed and DOSH/Cal-OSHA registered asbestos abatement contractor using work practices in accordance with the standards prescribed in 8 CCR 1529.





- Federal OSHA requires abatement/removal of ACM to be performed in accordance with the standards prescribed in 29 CFR 1926.1101.
- DTSC requires disposal of non-friable ACM that remains substantially intact as a Non-Friable/Non-Hazardous Asbestos Waste in California.
- **Friable ACM/RACM (friable, >1% asbestos):**
  - NESHAP and local air quality/pollution control districts require the abatement/removal of ACM, both friable and non-friable in California, prior to renovation or demolition activities which would disturb them. The abatement/removal must be performed in accordance with the local air quality/pollution control district regulatory standard, including containment and notification as applicable.
  - DOSH/Cal-OSHA requires abatement/removal of ACM to be performed by a California licensed and DOSH/Cal-OSHA registered asbestos abatement contractor using work practices in accordance with the standards prescribed in 8 CCR 1529.
  - Federal OSHA requires abatement/removal of ACM to be performed in accordance with the standards prescribed in 29 CFR 1926.1101.
  - DTSC requires disposal of friable ACM as a Friable/Hazardous Asbestos Waste in California.
- **ACCM (>0.1% asbestos):**
  - DOSH/Cal-OSHA requires disturbance/removal of ACCM to be performed using properly trained workers and special work practices in accordance with the standards prescribed in 8 CCR 1529.
  - DOSH/Cal-OSHA requires a "report of use" for disturbance/removal of ACCM (8 CCR 5203) and further requires a DOSH/Cal-OSHA registered contractor for disturbance/removal of 100 square feet or more of ACCM (California Labor Code 6500-6510).
- **Material containing asbestos (<0.1% asbestos):**
  - OSHA and DOSH/Cal-OSHA requires disturbance/removal of materials containing asbestos to be performed using properly trained workers and special work practices in accordance with the standards prescribed in 29 CFR 1926.1101 and 8 CCR 1529.

## 5.0 LEAD SAMPLING METHODOLOGY AND REGULATIONS

The lead-containing materials survey was conducted in accordance with applicable standards including, but not necessarily limited to the following: United State Department of Housing and Urban Development (HUD) 24 CFR Part 35 Lead Regulations and 1995 and 2012 Guidelines and EPA 40



CFR Part 745 lead regulations. The lead-containing materials survey was limited to materials/areas scheduled for disturbance within the survey area, as identified by the Client.

### ***Lead Paint Inspection***

The lead paint inspection included the following activities: (1) identifying homogenous testing combinations (similar room equivalent, component and substrate) of suspect LBP/LCM and (2) assessing the condition of each homogenous area of suspect LBP/LCM.

Once assessments are made, the paint is assigned a condition. These conditions are defined as follows:

- **Intact:** Paint with no visible deterioration or damage.
- **Deteriorated:** Paint that is cracking, chalking, flaking, chipping, peeling, non-intact, failed, or otherwise separating from a component.

### ***Lead Paint Testing/Sampling***

The lead paint testing/sampling included the following activities: (1) developing a representative testing/sampling plan for each homogenous area of suspect LBP/LCM and (2) conducting representative X-Ray fluorescence (XRF) testing of each homogenous area of suspect LBP/LCM.

In every "room equivalent" within the survey area, one (1) representative surface of each "testing combination" was tested. Commonly encountered interior components tested, if painted or varnished, include but are not necessarily limited to the following: walls, baseboards, doors, door trim, door jambs, windows trim, window sashes, and window sills. Commonly encountered exterior components tested, if painted or varnished, include but are not necessarily limited to the following: walls, fascia, trim, doors, door trim, door jambs, window assemblies and window wells.

XRF testing are documented by entering the test/sample data on a sample log, including a description of the material, sample number, location, condition, and estimated quantity. Typically, sample locations are marked on an 8-1/2 x 11-inch floor plan (not to scale).

### ***XRF Analysis***

A hand-held XRF lead paint analyzer was used to field analyze the presence of lead in painted surface(s). An appropriate number of XRF reading(s) were collected from the survey area. Multiple reading(s) were recorded to resolve inconsistencies in the XRF reading(s).

### **XRF INSTRUMENT SPECIFICATIONS**

Instrument Manufacturer:	Radiation Monitoring Devices, Inc. (RMD)
Model:	LPA-1B
Serial Number:	3614 and 3616
Modes of Operation:	Quick Mode for Inspection, Time Corrected Mode for Calibrations
Radioactive Source:	<sup>57</sup> Cobalt
Age of Radioactive Source:	Assayed September 27 <sup>th</sup> , 2011 and March 31 <sup>st</sup> , 2022



Calibration Standard: NIST Standard Reference Material of Red Paint Film with 1.02 mg/cm<sup>2</sup> content  
Operating Parameters: Action Level Mode

The RMD LPA-1 Spectrum Analyzer uses a <sup>57</sup>Co radioactive source and an advanced, solid-state, room temperature, radiation detector to generate and detect the x-ray fluorescence spectrum of a painted surface. The spectrum is then analyzed by a microprocessor to eliminate the effects of substrate and other factors such as scattering to allow an accurate determination of the amount of lead on a surface. Since the RMD LPA-1 is a Spectrum Analyzer, it can reject the signal from X-rays of unwanted energy. Although lead atoms emit X-rays at a unique energy, some gamma-rays emitted from the <sup>57</sup>Co "scatter" or bounce off the painted surface and into the LPA-1 XRF detector, and some of these rays have an energy very close to that of lead K-X-rays. The intensity of scattered gamma-rays depends on the nature of the substrate under the paint. In order to compensate for this scatter, the LPA-1 XRF detector measures the intensities of X-rays and gamma-rays at many energies and computes a correction for substrate. Accordingly, the analysis of the energy spectrum allows for a definitive reading, 95% confidence level, which is displayed on the instrument which accounts for substrate effects. The XRF reading(s) are expressed in milligrams lead per square centimeter of surface area (mg/cm<sup>2</sup>).

Based on the Performance Characteristic Sheet (PCS), no inconclusive reading(s) in the "Quick Mode" were encountered for paint on tested substrates. Inconclusive reading(s), however, may be encountered for paint on metal substrates.

### ***XRF Instrument Calibration Checks***

The calibration of the RMD LPA-1 is performed in accordance with of the HUD/EPA developed PCS Edition 5 for this instrument. Field calibration checks were performed prior, during and after each lead inspection to ensure the device functioning optimally within acceptable limits determined by the manufacturer. The Standard Reference Material (SRM) red paint film of 1.02 mg/cm<sup>2</sup>, developed by the National Institute of Standards and Technology (NIST), is the calibration standard. The LPA-1 instrument is calibrated the NIST standard with a minimum of three (3) calibration reading(s) in the "30-Second Equivalent Standard" mode performed before and after each inspection to ensure manufacturer's standards are met as indicated below. For inspection extending more than four (4) hours additional calibration check reading(s) are made every four (4) hours. Each set of calibration checks is averaged and compared to the PCS calibration check "30-Second Equivalent Standard" limit for the LPA-1 in the PCS. If for any reason the instruments are not maintaining a consistent calibration reading within the manufacturer's standards for performance on the calibration SRM supplied by the manufacturer, manufacturer's recommendations are used to bring the instrument into calibration. If the instrument cannot be brought back into calibration it is taken off the site and sent back to the manufacturer for repair and/or re-calibration.

### ***XRF Lead Sampling***

TES performed XRF Analyzer testing of one-hundred (100) surfaces painted/coated with suspect LBPs/LCMs in the survey area of the Subject Property preceded and followed by instrument



calibration, of which ninety-three surfaces were tested on December 18<sup>th</sup>, 2023 and seven surfaces were tested on January 3<sup>rd</sup>, 2024.

## 5.1 LEAD REGULATORY DEFINITIONS AND STANDARDS

### *Lead Regulatory Definitions*

The following is a list of some of regulatory definitions associated with lead paint:

- **Lead Based Paints/Coatings (LBP)** is defined by the United States Department of Housing and Urban Development (HUD) and the California Department of Public Health (CDPH) as paints/coatings that contain an amount of lead equal to, or in excess of 1.0 mg/cm<sup>2</sup>, 5,000 parts per million (ppm) or 0.5% by weight.
- **Lead Containing Paint (LCP)** Consumer Product Safety Commission (CPSC) under Title 16, CFR 1303.2, Consumer Product Safety Improvement Act of 2008, defines lead-containing paint (LCP) as paint or other similar surface coating materials containing more than 0.009 percent (90 mg/kg) lead.
- **Lead Abatement** is defined by HUD and CDPH as any set of measures designed to reduce or eliminate lead hazards or lead-based paint permanently or for a minimum of 20 years for public and residential buildings but does not include containment or cleaning.
- **Lead Related Construction Work** is defined by CDPH as any construction, alteration, painting, demolition, salvage, renovation, repair, or maintenance of any residential or public building, including preparation and cleanup that, by using or disturbing lead-containing material or soil, may result in significant exposures of adults or children to lead.
- **Lead Hazardous Waste:** Lead waste streams are characterized by analyzing total lead content and soluble lead content and comparing it to California Title 22 Total Threshold Limit Concentrations of 1000 ppm and Solubility Threshold Limit Concentration of 5 mg/L, respectively. If any of these two (2) limits are equaled or exceeded, then the lead waste stream is classified as California Hazardous Waste and must be packaged and disposed in Class I or Class II landfills. Furthermore, the lead waste stream is tested for soluble lead in accordance with USEPA Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leachate Procedure (TCLP) of 5 mg/L. If the TCLP is equaled or exceeded, the lead waste stream is classified as RCRA Waste.

### *Lead Regulatory Standards Summary*

At present there is no state or federal regulation requiring mandatory lead removal or abatement prior to disturbance of building materials with identified lead paint or coatings. However, there are applicable Cal/OSHA worker protection and training requirements, Cal/EPA waste disposal requirements, CDPH requirements for public and residential buildings, and SB 460 lead hazard regulations that apply to lead-related construction activities, abatement activities and the associated lead wastes. The following is a brief discussion and summary of applicable regulatory requirements:





♦ **Cal/OSHA:** Title 8, California Code of Regulation (CCR), Section 1532.1 (8 CCR 1532.1) governs occupational exposure to lead. This regulation requires that prior to initiation of certain activities, referred to as “trigger tasks”, workers must be trained, medically evaluated, and properly fitted with respiratory protection, and protective clothing until statistically reliable personal eight-hour time weighted average (TWA) results indicate lead exposure levels below the Personal Exposure Limit (PEL) for each unique task which disturbs lead-based and lead-containing coatings. This process is known as a Negative Exposure Assessment or NEA.

If the result of the exposure assessment is above the Action Level (AL) additional monitoring is required and if the result is above the PEL additional exposure monitoring, worker protection (including respirator protection and PPE), training and medical requirements apply. However even where the NEA criteria is met, certain hazard communication training and work practice controls still apply where lead is disturbed. “Trigger tasks” are tasks that are assumed to exceed the PEL pending an exposure assessment and they encompass the majority of construction activities that disturb surface coatings.

Examples of “trigger” tasks range from manual paint scraping as a lower expected exposure up to hot work and abrasive blasting as the highest expected exposures, and include any non-listed task that the employer determines may potentially expose employees to lead levels above the AL.

*“OSHA does not consider any method that relies solely on the analysis of bulk materials or surface content of lead (or other toxic material) to be acceptable for safely predicting employee exposure to airborne contaminants. Without air monitoring results or without the benefit of historical or objective data (including air sampling which clearly demonstrates that the employee cannot be exposed above the action level during any process, operation, or activity) the analysis of bulk or surface samples cannot be used to determine employee exposure.”- OSHA Standard Interpretation May 8, 2000.*

OSHA states that these rules apply to “any detectable concentration of lead” without a specified detection level. Due to the Consumer Product Safety Commission currently allowing paint to contain up to 90 parts per million (ppm) or 0.009 wt% of lead, the variation of lead content due to aging and weathering, and the variation of detection limits associated with analysis of bulk materials, such as paint chips and surface content analysis via XRF, it is recommended that all painted or coated surfaces be treated as potentially containing lead.

Positive analytical results by either method can be used to indicate that detectable lead is present but negative results cannot be interpreted as conclusively demonstrating the absence of lead. Analytical data from analysis of bulk materials or surface content of lead can be helpful in evaluation of lead-related environmental risks in general but cannot be used to calculate worker exposures and are not a substitute for employee exposure monitoring.

As a result of the above, any employee that works around potential lead-based or lead-containing coatings must have HAZCOM training and personal exposure air monitoring is additionally required



for employees that disturb such coatings. Additional certification, notification, and work practices are required for materials found to be lead-based paint.

Any welding, cutting or heating of metal surfaces containing surface coatings should be conducted in accordance with 29 CFR 1926.354 and 8 CCR 1537 and/or 1536. These regulations require surfaces covered with toxic preservatives, and in enclosed areas, be stripped of all toxic coatings for a distance of at least 4 inches, in all directions, from the area of heat application prior to the initiation of such heat application with adequate exhaust ventilation.

♦ **Cal/EPA:** The Department of Toxic Substance Control (DTSC) regulates disposal of lead hazardous waste (22 CCR Division 4.5, Minimum Standards for Management of Hazardous and Extremely Hazardous Wastes). DTSC has issued guidance indicating that architectural debris with intact lead paint is normally expected to be handled as general construction waste. However, waste stream segregation and analysis is still required for all lead painted or coated debris regardless of if the paint or coating is intact on a building component or not. The resulting wastes may be hazardous under California and federal RCRA standards for lead and therefore require proper handling, packaging, labeling, and transportation under a proper manifest to a permitted hazardous waste storage, treatment and disposal facility.

♦ **Los Angeles County Department of Health Services (LAC DHS):** Title 11, Health & Safety, Division 1-Health Code, Chapter 11.28-Lead Hazards, 11.28.010 defines "Dangerous levels of lead-bearing substances" means any paint, varnish, lacquer, putty, plaster, or similar coating or structural material which contains lead or its compounds in excess of seven-tenths (0.7) of one milligram per square centimeter, when measured by a lead-detecting instrument approved by the director; or any substance, when measured by scientifically accepted method, in a quantity determined by the director to constitute a hazard to children; or that level as determined in the most recent standards as established by the United States Department of Health, Education and Welfare, Public Health Service, Center for Disease Control.

♦ **Senate Bill 460 (SB 460):** An act to amend Section 1941.1 of the Civil Code, and to amend Sections 17961, 17980, and 124130 of, and to add Sections 17920.10, 105251, 105252, 105253, 105254, 105255, 105256, and 105257 to, the Health and Safety Code, relating to lead abatement. This bill allows for fines and criminal penalties to be levied by local code enforcement agencies on any person who is found to have performed lead abatement without containment or created a measurable "lead hazard" based upon current CDPH standards. A "lead hazard" means deteriorated lead-based paint, lead contaminated dust, lead contaminated soil, disturbing lead-based paint or presumed lead-based paint without containment, or any other nuisance which may result in persistent and quantifiable lead exposure.

TES recommends that all parties who come into contact with paint or soil that have detectable lead concentrations follow all applicable federal, state and local regulations relating to employee health and safety and proper disposal of generated wastes.



## **6.0 SUSPECT ACM/ACCM SAMPLING ANALYTICAL RESULTS**

### **6.1 ASBESTOS ANALYTICAL RESULTS SUMMARY**

Table 6-1, included in the tables section of this report, provides a summary of suspect ACM/ACCM samples analytical results.

### **6.2 SUSPECT ACMs/ACCMs NOT SAMPLED**

The suspect ACMs/ACCMs listed below may be present at the Subject Property and due to the non-destructive nature of this survey were not sampled in order to avoid (1) hazardous conditions, (2) impacting the integrity of the structure, (3) damaging building materials and finishes that cannot be easily repaired, (4) damaging equipment and/or mechanical systems, (5) voiding warranties, and/or (6) creating hazards including, but not limited to, an asbestos fiber release episode. If any of the following materials are identified at the Subject Property, these materials should be considered ACMs unless a DOSH/Cal-OSHA CAC determines they are not asbestos-containing.

- Cement asbestos/transite materials including, but not limited to:
  - Cement flues and pipes
- Inaccessible and/or concealed materials including, but not limited to:
  - Glues
  - Mastics, Chalkboard Mastic Adhesive, Blackboard Mastic, Whiteboard Mastic, Corkboard Mastic
  - Fire door with asbestos-containing insulation materials
  - Underlayment
- Pipe Coal Tar Wrapping, Pipe Coating, Bituminous Pipe Wrapping, Resin Wrapping

### **6.3 NON-SUSPECT ACMs/ACCMs**

The non-suspect ACMs/ACCMs listed below may be present at the Subject Property and were not sampled because they were determined to be non-suspect by a DOSH/Cal-OSHA CAC.

- Fiberglass: insulation, etc.;
- Glass: windows, doors, mirrors, etc.;
- Laminate/faux wood: flooring, wall covering, etc.;
- Metal materials/finishes: door and window framing, ducting, etc.;
- Terrazzo: flooring, wall covering, etc.; and
- Wood and laminate flooring materials/finishes: flooring, wall paneling, framing, etc.

## **7.0 SUSPECT LCM/LBP SAMPLING ANALYTICAL RESULTS**

Table 7-1, included in the tables section of this report, provides a summary of the XRF sampling results.



## **8.0 CONCLUSIONS AND RECOMMENDATIONS**

### **ASBESTOS-CONTAINING BUILDING MATERIALS**

TES has the following conclusions and recommendations based on the findings of the asbestos-containing building materials survey:

- The asbestos survey was performed in accordance with the EPA's NESHAP asbestos regulations protocol for sample collection for demolition/renovation surveys and SCAQMD Rule 1403 and sample analysis in accordance with EPA's "Method for the Determination of Asbestos in Bulk Building Materials" (EPA 600-R-93-116).
- A California licensed and DOSH/Cal-OSHA registered asbestos abatement contractor should be contracted to remove/abate ACMs/ACCMs and materials containing asbestos that are damaged or will be disturbed.
- A DOSH/Cal-OSHA Certified Asbestos Consultant should be contracted to conduct monitoring and clearance of any removal/abatement of ACMs/ACCMs and materials containing asbestos.
- Any materials that have not been identified in this report should be considered suspect ACMs/ACCMs and handled as ACM unless sampled by a DOSH/Cal-OSHA Certified Asbestos Consultant proven to be non-ACM by laboratory analysis.
- Material quantities provided in this report are for information purposes exclusively, and are not intended to be the basis of a contractor's bid for removal or abatement. Contractors are required to field verify materials and quantities for the purposes of bidding on contracted work.
- All asbestos activities must be performed in accordance with all applicable federal, state and local regulations including, but not limited to those summarized in this report.

### **LEAD-BASED PAINTS / LEAD-CONTAINING MATERIALS**

TES has the following conclusions and recommendations based on the findings of the lead in paint survey:

- For the purpose of this lead survey, any material containing any detectable level of lead is subject to OSHA's Lead Exposure in Construction Rule Title 29, Code of Federal Regulations, Part 1926, Section 62 (29 CFR 1926.62) and Title 8, California Code of Regulations, Section 1532.1 (8 CCR 1532.1).
- In accordance with Title 29, Code of Federal Regulations, Part 1926, Section 62 (29 CFR 1926.62) and Title 8, California Code of Regulations, Section 1532.1 (8 CCR 1532.1), any disturbance of LCM and/or LBP should be performed by lead hazard communication trained workers using lead safe work practices that do not result in exposures above the Action Level



(AL) of 30 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) and/or Permissible Exposure Limit (PEL) of 50  $\mu\text{g}/\text{m}^3$ .

- In accordance with Resource Conservation and Recovery Act (RCRA) Title 40, Code of Federal Regulations, Part 261 (40 CFR 261) and California Department of Toxic Substance Control (DTSC) requirements, all lead containing wastes should be sampled and analyzed for total and leachable lead concentrations and disposed of accordingly based on the waste characterization analytical results.
- Any paints/coatings that have not been identified in this report should be considered presumed LBP and handled as LBP unless sampled by a CDPH Certified Lead Inspector/Assessor and proven to be non-LBP by laboratory analysis.
- All lead activities must be performed in accordance with all applicable federal, state and local regulations, including but not limited to those summarized in this report.

## 9.0 CERTIFICATION

This sampling, including preparation of this report, was conducted under the direction of Robert Menald, (CAC No. 08-4323 and CDPH LRCIA No. LRC-00005260), and Ibrahim M. Sobeih (CAC No. 06-4078, CDPH LRCIA No. LRC-00011308 and CIH in the Comprehensive Practice by the Board for Global EHS Credentialing [BGC Certificate No. 5628CP]), undersigned. If you have any questions or require any additional information or services, please contact our office toll free at (888) 948-4826.

Sincerely,

**Titan Environmental Solutions, Inc.**



Robert Menald, CIEC, CAC, LRCIA  
Project Manager



Ibrahim M. Sobeih, MS, MSPH, CIH, CAC, LRCIA  
Director of Industrial Hygiene and Safety



## 10.0 LIMITATIONS

TES is committed to providing state-of-the-art environmental consulting services that are of the highest quality. However, asbestos and lead-containing materials survey work is not an exact science. The possibility of field and general conditions beyond TES control that affect our work or that present a concern for the safety of our employees, our consultants, building occupants and the public at the site, and insurance constraints, requires that we qualify the services we provide with the following limitations:



- In accordance with the client specified scope of work, this survey was limited to accessible building materials and areas at the Subject Property identified by the Client; no destructive investigation was performed. Additional suspect materials located in inaccessible areas and/or outside the scope of this survey may be present at the Subject Property.
- Reasonable effort is made by TES personnel to locate and sample all suspect hazardous materials. However, for any building there is the possibility that various types of unique or concealed hazardous materials may exist undetected. In addition, sampling and laboratory analyses constraints typically hinder the investigation. TES does not warrant, guarantee or profess to have the ability to locate or identify all hazardous materials in a building.
- Confined spaces and areas determined by TES personnel to be unsafe to access, are excluded from the scope of work.
- TES is not, and has no responsibility as, a generator, operator, treater, storer, transporter or disposer of hazardous materials or waste found or identified as a result of TES work.
- TES does not guarantee or warrant that the Subject Property or workplace are safe, nor does TES involvement in this property relieve the Client, building owner/operator or tenant of any continuing responsibility of providing a safe property or workplace.
- This report was based on those conditions observed on the day(s) the field evaluation was accomplished. In the event that changes in the nature of the property have occurred, or additional relevant information about the property is subsequently discovered, the findings and recommendations contained in this report may not be valid unless these changes and additional relevant information are reviewed and the conclusion of this report is modified and verified in writing.
- It is understood that the survey is a non-destructive assessment of potential hazardous materials and is to be used expressly for the purpose of evaluating the risk relative to the expected material disturbance at the Subject Property. Because destructive investigation has not been performed during the survey, the report may not reveal concealed hazardous materials. Subsequently, additional investigation including construction documents review and/or destructive investigation is recommended as a precaution to prevent accidental exposure when construction or demolition is planned for this Subject Property.
- It is understood that this is a modified survey and results are limited to the specific areas and materials sampled. This report is not valid for use outside of the specific areas identified by the Client or by individuals not associated with the currently planned work at the Subject Property.



## TABLES



**Table 6-1: Asbestos Sampling PLM Analytical Results**

HA No.	Sample No.	Sample Locations	Material Description	Class	Material Location(s)*	Friable/ Non-Friable	Condition (G, D, SD)	Estimated Quantity*	Asbestos Analytical Results	SCAQMD Cat.
01	1218-01-01 1218-01-02 1218-01-03	Center W Wall Crafts Room E End S Wall Office Center S Wall Storage	Dark Gray 4" Cove Base	Misc.	Lower Walls Throughout Crafts Room, Office and Storage	NF	G	40 SF	ND	Non-ACM
02	1218-02-04 1218-02-05 1218-02-06	Center W Wall Crafts Room E End S Wall Office Center S Wall Storage	Off-White Cove Base Adhesive	Misc.	Lower Walls Throughout Crafts Room, Office and Storage	NF	G	40 SF	ND	Non-ACM
03	1218-03-07 1218-03-08 1218-03-09 1218-03-10 1218-03-11	Center N Wall Preschool W End N Wall Preschool N End E Wall Preschool W End S Wall Preschool Center S Wall Preschool	White Stucco with Texture	Surf.	Throughout Exterior Walls	F	G	1,500 SF	ND	Non-ACM
04	1218-04-12 1218-04-13 1218-04-14	S Ceiling Crafts Room Center Ceiling Crafts Room N Ceiling Office	White 12"x12" Ceiling Tile (No Mastic)	Misc.	Ceiling of Crafts Room and Office	F	G	650 SF	ND	Non-ACM
05	1218-05-15 1218-05-16 1218-05-17	Center Floor Men's Bathroom Center Floor Men's Bathroom Center Floor Women's Bathroom	Gray Floor Coating	Misc.	Men's and Women's Bathroom Floor	NF	G	400 SF	ND	Non-ACM
06	1218-06-18 1218-06-19 1218-06-20	Center Floor Crafts Room E Floor Office Center Floor Storage	2'x4' Ceramic Floor Tile (Under Vinyl Floor Tile)	Misc.	Throughout Crafts Room, Office and Storage Floors	NF	G	800 SF	ND	Non-ACM
07	1218-07-21 1218-07-22 1218-07-23	Center Floor Crafts Room E Floor Office E Floor Office	Floor Tile Mastic	Misc.	Throughout Floors Under Tiles of Crafts Room, Office and Storage	NF	G	800 SF	ND	Non-ACM
08	1218-08-24 1218-08-25 1218-08-26	SW Roof Crafts Room, Office and Storage Roof SW Roof Crafts Room, Office and Storage Roof SW Roof Crafts Room, Office and Storage Roof	Foam Roof Core with White Texture Coat	Misc.	SW Corner Roof of Crafts Room, Office and Storage	NF	G	200 SF	ND	Non-ACM
09	1218-09-27 1218-09-28 1218-09-29	Center Roof - Roof Penetration N Roof - Roof Penetration S Roof - Roof Penetration	Black Roof Penetration Mastic	Misc.	Throughout Roof Penetrations	NF	G	50 SF	3% Chrysotile	Class I ACM





**Table 6-1: Asbestos Sampling PLM Analytical Results**

HA No.	Sample No.	Sample Locations	Material Description	Class	Material Location(s)*	Friable/ Non-Friable	Condition (G, D, SD)	Estimated Quantity*	Asbestos Analytical Results	SCAQMD Cat.
10	1218-10-30 1218-10-31 1218-10-32	E Roof - Roof of Building Center Roof - Roof of Building S Roof - Roof of Building	BUR Roof Core with Gravel	Misc.	Throughout Roof Except Foam Core	NF	G	650 SF	ND	Non-ACM
11	1218-11-33 1218-11-34 1218-11-35	N End W Wall Men's Restroom N End W Wall Men's Restroom N End W Wall Men's Restroom	White 6"x6" Wall Tile	Misc.	Select Walls in Bathrooms	NF	G	150 SF	ND	Non-ACM
12	1218-12-36 1218-12-37 1218-12-38	Center Floor Men's Restroom Center Floor Men's Restroom Center Floor Men's Restroom	Brown Floor Tile (Bathrooms)	Misc.	Select Floors in Bathrooms	NF	G	100 SF	ND	Non-ACM
13	0103-13-39 0103-13-40 0103-13-41 0103-13-42 0103-13-43	S. End TLO Office Wall Light Switch E. End TLO Crafts Wall Light Switch N. End Women's Restroom Wall Light Switch N. End Maintenance Room Wall Light Switch S. End Electrical Room Wall Light Switch	White and Gray Plaster	Surf.	Within TLO Crafts, Office, Storage, Maintenance, Electrical, Women's Restroom and Men's Restroom	F	G	2,700 SF	ND	Non-ACM

**Legend:**

HA = Homogenous Area  
 N = North, E = East, W = West, S = South, SF = Square Feet, LF = Linear Feet, ND = None Detected  
 Classification (Class.): Misc. = Miscellaneous, Surf. = Surfacing, TSI = Thermal System Insulation  
 Condition: G = Good, D = Damaged, SD = Significantly Damaged  
 Categories (Cat.):

- Cal/OSHA: ACCM = Asbestos Containing Construction Materials, ACM = Asbestos Containing Materials,
- NESHAP: Cat I = Category I Non-friable ACM, Cat II = Category II Non-friable ACM, RACM = Regulated Asbestos Containing Material
- SCAQMD: Class I = Class I Non-friable ACM, Class II = Class II Non-friable ACM, FACM = Friable Asbestos Containing Material

\*Locations and quantities are estimates based on accessible materials located in the survey area only. Additional locations and quantities may be present at the Subject Property.

\*\*In accordance to 40 CFR 61.141 and US EPA Applicability Determination Index Control Number: C112, if the amount by visual estimation appears to be less than 10 percent, the owner or operator may (1) assume the amount to be greater than 1 percent and treat the materials asbestos-containing material, or (2) require verification of the amount by point counting. If a result obtained by point count is different from a result obtained by visual estimation, the point count result will be used.

Please note the Certified Asbestos Consultant will assume any material that is <1% analyzed via PLM and not verified by point count as an Asbestos Containing Material (ACM).



**Table 7-1: Lead-Paint XRF Analyzer Results**

Reading	Room / Location*	Side <sup>1</sup>	Structure	Condition <sup>2</sup>	Substrate	Color	Lead Concentration (mg/cm <sup>2</sup> )	Classification <sup>3</sup>
1	Calibration						1.0	
2	Calibration						1.0	
3	Calibration						1.0	
4	Crafts room	E	Wall	I	Drywall	Light Yellow	-0.2	BDL
5	Crafts room	Center	Ceiling Tile	I	Compressed	White	-0.1	BDL
6	Crafts room	W	Wall	I	Drywall	Light Green	-0.2	BDL
7	Crafts room	E	Door	I	Metal	Tan	-0.2	BDL
8	Crafts room	E	Door Jamb	I	Metal	Tan	-0.1	BDL
9	Crafts room	N	Window Trim	I	Wood	Light Brown	-0.4	BDL
10	Crafts room	Center	Beam	I	Wood	White	-0.3	BDL
11	Crafts room	N	Cabinet	I	Wood	Light Brown	-0.2	BDL
12	Crafts room	E	Cabinet	I	Wood	Tan	-0.3	BDL
13	Crafts room	N	Countertop	I	Wood	Light Brown	-0.4	BDL
14	Crafts room	E	Countertop	I	Wood	Tan	-0.2	BDL
15	Crafts room	E	Heater	I	Metal	Gray	-0.1	BDL
16	Crafts room	Center	Vent	I	Metal	White	-0.4	BDL
17	Crafts room	E	Exhaust fan	I	Metal	Light Green	-0.1	BDL
18	Crafts room	E	Cabinet	I	Wood	Light Green	-0.2	BDL
19	Crafts room	W	Door	I	Wood	Tan	-0.4	BDL
20	Crafts room	W	Door Jamb	I	Wood	Tan	-0.2	BDL
21	Office of crafts room	N	Wall	I	Drywall	White	-0.4	BDL
22	Office of crafts room	Center	Ceiling Tile	I	Compressed	White	-0.2	BDL
23	Office of crafts room	S	Vent	I	Metal	White	-0.3	BDL
24	Office of crafts room	W	Door	I	Metal	Dark Brown	-0.2	BDL
25	Office of crafts room	W	Door Jamb	I	Metal	Dark Brown	-0.2	BDL
26	Office of crafts room	N	Window Trim	I	Metal	Dark Brown	-0.3	BDL
27	Office of crafts room	E	Heater	I	Metal	Tan	-0.1	BDL
28	Office of crafts room	E	Heater frame	I	Metal	White	-0.3	BDL
29	Office of crafts room	E	Cabinet	I	Wood	Yellow	-0.1	BDL
30	Office of crafts room	W	Cabinet	I	Wood	Light Brown	-0.2	BDL
31	Office of crafts room	E	Door	I	Wood	Dark Brown	-0.4	BDL
32	Office of crafts room	E	Door Jamb	I	Wood	Dark Brown	-0.4	BDL
33	Closet of Crafts room	S	Wall	I	Drywall	Tan	-0.2	BDL
34	Closet of Crafts room	Center	Ceiling	I	Wood	Tan	-0.2	BDL
35	Closet of Crafts room	Center	Beam	I	Wood	Tan	-0.3	BDL
36	Closet of Crafts room	Center	Exhaust fan	I	Metal	Gray	-0.4	BDL
37	Closet of Crafts room	E	Cabinet	I	Wood	Light Brown	-0.2	BDL
38	Closet of Crafts room	N	Door	I	Wood	Dark Brown	-0.4	BDL
39	Closet of Crafts room	N	Door Jamb	I	Wood	Dark Brown	-0.4	BDL
40	Men's Restroom	W	Wall	I	Drywall	Tan	-0.3	BDL
41	Men's Restroom	Center	Ceiling	I	Wood	Tan	-0.2	BDL
42	Men's Restroom	Center	Floor	D	Concrete coating	Gray	0.0	BDL
43	Men's Restroom	E	Sink	I	Porcelain	White	-0.6	BDL
44	Men's Restroom	W	Toilet	I	Porcelain	White	-0.6	BDL
45	Men's Restroom	W	Toilet wall	I	Wood	Black	-0.4	BDL
46	Men's Restroom	W	Urinal	I	Porcelain	White	-0.6	BDL



**Table 7-1: Lead-Paint XRF Analyzer Results**

Reading	Room / Location*	Side <sup>1</sup>	Structure	Condition <sup>2</sup>	Substrate	Color	Lead Concentration (mg/cm <sup>2</sup> )	Classification <sup>3</sup>
47	Men's Restroom	W	Urinal floor	I	Ceramic	Orange	-0.3	BDL
48	Men's Restroom	Center	Urinal wall	I	Ceramic	White	8.9	<b>LBP</b>
49	Men's Restroom	N	Door	I	Metal	Black	-0.2	BDL
50	Men's Restroom	N	Door Jamb	I	Metal	Black	-0.2	BDL
51	Men's Restroom	S	Door	I	Wood	Tan	-0.4	BDL
52	Men's Restroom	S	Door Jamb	I	Wood	Tan	-0.4	BDL
53	Men's Restroom	Center	Beam	I	Wood	Tan	-0.3	BDL
54	Men's Restroom	N	Wall	I	Plaster	Tan	-0.1	BDL
55	Men's Restroom	W	Heater window	I	Metal	Tan	-0.1	BDL
56	Men's Restroom	Center	Mesh	I	Metal	Tan	-0.2	BDL
57	Women's Restroom	N	Wall	I	Plaster	Tan	-0.1	BDL
58	Women's Restroom	Center	Ceiling	I	Wood	Tan	-0.2	BDL
59	Women's Restroom	Center	Floor	D	Concrete coating	Gray	0.0	BDL
60	Women's Restroom	W	Sink	I	Porcelain	White	-0.6	BDL
61	Women's Restroom	E	Toilet	I	Porcelain	White	-0.6	BDL
62	Women's Restroom	E	Toilet wall	I	Wood	Black	-0.4	BDL
63	Women's Restroom	N	Door	I	Wood	Black	-0.1	BDL
64	Women's Restroom	N	Door Jamb	I	Wood	Gray	-0.1	BDL
65	Women's Restroom	S	Door	I	Wood	Tan	0.2	<b>LCM</b>
66	Women's Restroom	S	Door Jamb	I	Wood	Tan	-0.2	BDL
67	Women's Restroom	Center	Beam	I	Wood	Tan	-0.3	BDL
68	Women's Restroom	E	Heater window	I	Metal	Tan	-0.2	BDL
69	Main closet	N	Wall	I	Plaster	Tan	-0.1	BDL
70	Main closet	Center	Ceiling	I	Wood	Tan	-0.2	BDL
71	Main closet	N	Door	I	Wood	Black	-0.5	BDL
72	Main closet	N	Door Jamb	I	Wood	White	-0.4	BDL
73	Main closet	S	Cabinet	I	Wood	Dark Brown	-0.3	BDL
74	Main closet	W	Main water line	I	Metal	Tan	-0.3	BDL
75	Main closet	E	Water line	I	Metal	Brown	-0.1	BDL
76	Main closet	W	Electric box	I	Metal	Tan	-0.2	BDL
77	E storage	N	Wall	I	Stucco	Light Yellow	-0.3	BDL
78	E storage	Center	Ceiling	I	Drywall	Light Yellow	-0.3	BDL
79	E storage	E	Door	D	Wood	Light Yellow	-0.1	BDL
80	E storage	E	Door Jamb	I	Wood	Light Yellow	-0.2	BDL
81	Front patio	S	Wall	I	Stucco	Light Yellow	-0.1	BDL
82	Front patio	Center	Beam	I	Wood	Dark Green	-0.3	BDL
83	Front patio	N	Pole	I	Wood	Dark Green	-0.3	BDL
84	Front patio	Center	Ceiling	I	Wood	Dark Green	-0.3	BDL
85	Front patio	N	Fascia	I	Metal	Dark Green	-0.2	BDL
86	Front patio	S	Door	I	Metal	Black	-0.1	BDL
87	Front patio	S	Door Jamb	I	Metal	Black	-0.1	BDL
88	Front patio	S	Louver	I	Wood	Light Yellow	-0.3	BDL
89	Back courtyard	N	Wall	I	Stucco	Tan	-0.1	BDL
90	Back courtyard	S	Wall	I	Brick	Tan	-0.4	BDL
91	Back courtyard	E	Wall	I	Brick	Multi-color	-0.1	BDL
92	Back courtyard	N	Electric box	I	Metal	Tan	-0.1	BDL



**Table 7-1: Lead-Paint XRF Analyzer Results**

Reading	Room / Location*	Side <sup>1</sup>	Structure	Condition <sup>2</sup>	Substrate	Color	Lead Concentration (mg/cm <sup>2</sup> )	Classification <sup>3</sup>
93	Back courtyard	S	Gate	I	Metal	Black	-0.2	BDL
94	Back courtyard	E	Storage	I	Metal	Black	-0.2	BDL
95	Exterior	N	Window Trim	I	Wood	Light Yellow	-0.1	BDL
96	Office of Crafts room	S	Defibrillators box	I	Metal	Tan	-0.3	BDL
97	Calibration						1.0	
98	Calibration						1.0	
99	Calibration						1.0	
100	Calibration						1.0	
101	Calibration						1.1	
102	Calibration						1.1	
103	Men's Restroom	E	Wall	I	Plaster	White	-0.4	BDL
104	Women's Restroom	N	Wall	I	Plaster	White	-0.5	BDL
105	Electrical Room	N	Wall	I	Plaster	Tan	-0.4	BDL
106	Maintenance Room	S	Wall	I	Plaster	Tan	-0.4	BDL
107	Craft Room	E	Wall	I	Plaster	Beige	-0.3	BDL
108	Office	W	Wall	I	Plaster	Beige	-0.4	BDL
109	Storage	W	Wall	I	Plaster	Beige	-0.3	BDL
110	Calibration						1.1	
111	Calibration						1.0	
112	Calibration						1.0	

**Legend:**

<sup>1</sup>Side: N = North, E = East, W = West, S = South

<sup>2</sup>Paint Condition: I = Intact, D = Deteriorated

<sup>3</sup>Classification:

- BDL = Below the XRF's detection level; <0.1 mg/cm<sup>2</sup>.

- **LCM** = Lead Containing Materials (LCM); ≥0.1 mg/cm<sup>2</sup>

- **LBP** = Lead-Based Paints (LBP); >0.7 mg/cm<sup>2</sup>.

- LA County Department of Health Services (DHS), LA County Code Title 11, Health & Safety, Chapter 11.28, section 11.28.010 defines LBP as paint or other surfacing coating which contains lead or its compounds in excess of seven-tenths of one milligram per square centimeter (>0.7 mg/cm<sup>2</sup>).

\*Locations are estimates based on accessible materials located in the survey area only. Additional locations may be present at the Subject Property.





Asbestos and Lead-Containing Materials Renovation Survey Report  
El Dorado Park Renovation  
44501 5<sup>th</sup> Street, Lancaster, CA 93535  
Project No. 118291 -AS, XRF  
January 5, 2024

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## **ATTACHMENTS**



**ATTACHMENT I**

**LABORATORY ANALYTICAL REPORT(S)  
(INCLUDING CHAIN OF CUSTODY FORMS)**

# Bulk Asbestos Analysis

(EPA Method 40CFR, Part 763, Appendix E to Subpart E and EPA 600/R-93-116, Visual Area Estimation)  
NVLAP Lab Code: 101459-1

TITAN Environmental Solutions, Inc.  
Tony Lam  
1521 E. Orangethorpe Ave.  
Suite B  
Fullerton, CA 92831

**Client ID:** L1630  
**Report Number:** B354987  
**Date Received:** 12/19/23  
**Date Analyzed:** 12/26/23  
**Date Printed:** 12/26/23  
**First Reported:** 12/26/23

**Job ID/Site:** 118291-AS, XRF; El Dorado Park Renovation, 44501 5th St, Lancaster, CA 93535

**SGSFL Job ID:** L1630  
**Total Samples Submitted:** 38  
**Total Samples Analyzed:** 36

**Date(s) Collected:** 12/18/2023

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
<b>1218-01-01</b>	51718347						
Layer: Dark Grey Non-Fibrous Material			ND				
Layer: Beige Mastic			ND				
Layer: Tan Mastic			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-01-02</b>	51718348						
Layer: Dark Grey Non-Fibrous Material			ND				
Layer: Beige Mastic			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-01-03</b>	51718349						
Layer: Dark Grey Non-Fibrous Material			ND				
Layer: Beige Mastic			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-02-04</b>	51718350						
Layer: Beige Mastic			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-02-05</b>	51718351						
Layer: Beige Mastic			ND				
Layer: Brown Mastic			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							

**Client Name:** TITAN Environmental Solutions, Inc.

**Report Number:** B354987

**Date Printed:** 12/26/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
<b>1218-02-06</b>	51718352						
Layer: Beige Mastic			ND				
Layer: Brown Mastic			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-03-07</b>	51718353						
Layer: Grey Cementitious Material			ND				
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-03-08</b>	51718354						
Layer: Grey Cementitious Material			ND				
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-03-09</b>	51718355						
Layer: Grey Cementitious Material			ND				
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-03-10</b>	51718356						
Layer: Grey Cementitious Material			ND				
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-03-11</b>	51718357						
Layer: Grey Cementitious Material			ND				
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-04-12</b>	51718358						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (95 %)							



**Client Name:** TITAN Environmental Solutions, Inc.

**Report Number:** B354987

**Date Printed:** 12/26/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
<b>1218-04-13</b>	51718359						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (95 %)							
<b>1218-04-14</b>	51718360						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (95 %)							
<b>1218-05-15</b>	51718361						
Layer: Paint/Coating			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)      Fibrous Glass (Trace)							
<b>1218-05-16</b>	51718362						
Layer: Paint/Coating			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)      Fibrous Glass (Trace)							
<b>1218-05-17</b>	51718363						
Layer: Paint/Coating			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)      Fibrous Glass (Trace)							
<b>1218-06-18</b>	51718364						
Layer: Tan Mastic			ND				
Layer: Tan Tile			ND				
Layer: Tan Mastic			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-06-19</b>	51718365						
Layer: Tan Mastic			ND				
Layer: Tan Tile			ND				
Layer: Tan Mastic			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-06-20</b>	51718366						
Layer: Tan Mastic			ND				
Layer: Tan Tile			ND				
Layer: Tan Mastic			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-07-21</b>	51718367						
Layer: Tan Mastic with Debris			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							

**Client Name:** TITAN Environmental Solutions, Inc.

**Report Number:** B354987

**Date Printed:** 12/26/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
<b>1218-07-22</b>	51718368						
Layer: Tan Mastic with Debris			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-07-23</b>	51718369						
Layer: Tan Mastic with Debris			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-08-24</b>	51718370						
Layer: White Non-Fibrous Material			<b>ND</b>				
Layer: Yellow Foam			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-08-25</b>	51718371						
Layer: White Non-Fibrous Material			<b>ND</b>				
Layer: Yellow Foam			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-08-26</b>	51718372						
Layer: White Non-Fibrous Material			<b>ND</b>				
Layer: Yellow Foam			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-09-27</b>	51718373						
Layer: Black Semi-Fibrous Tar		Chrysotile	<b>3 %</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-09-28</b>	51718374						
Comment: Sample not analyzed due to prior positive result in series.							
<b>1218-09-29</b>	51718375						
Comment: Sample not analyzed due to prior positive result in series.							
<b>1218-16-30</b>	51718376						
Layer: Stones			<b>ND</b>				
Layer: Black Semi-Fibrous Tar			<b>ND</b>				
Layer: Brown Fibrous Material			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (45 %)							
<b>1218-16-31</b>	51718377						
Layer: Stones			<b>ND</b>				
Layer: Black Semi-Fibrous Tar			<b>ND</b>				
Layer: Brown Fibrous Material			<b>ND</b>				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (45 %)							

**Client Name:** TITAN Environmental Solutions, Inc.

**Report Number:** B354987

**Date Printed:** 12/26/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
<b>1218-16-32</b>	51718378						
Layer: Stones			ND				
Layer: Black Semi-Fibrous Tar			ND				
Layer: Brown Fibrous Material			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (45 %)							
<b>1218-17-33</b>	51718379						
Layer: Paint			ND				
Layer: Beige Ceramic Tile			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-17-34</b>	51718380						
Layer: Paint			ND				
Layer: Beige Ceramic Tile			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1218-17-35</b>	51718381						
Layer: Paint			ND				
Layer: Beige Ceramic Tile			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1215-18-36</b>	51718382						
Layer: Brown Ceramic Tile			ND				
Layer: Grey Grout			ND				
Layer: Grey Mortar			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1215-18-37</b>	51718383						
Layer: Brown Ceramic Tile			ND				
Layer: Grey Grout			ND				
Layer: Grey Mortar			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
<b>1215-18-38</b>	51718384						
Layer: Brown Ceramic Tile			ND				
Layer: Grey Grout			ND				
Layer: Grey Mortar			ND				
Total Percentage Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							

**Client Name:** TITAN Environmental Solutions, Inc.

**Report Number:** B354987

**Date Printed:** 12/26/23

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
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Eric Cerecedo, Laboratory Supervisor, Carson Laboratory

**Note:** Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

Analytical results and reports are generated by SGS Forensic Laboratories (SGSFL) at the request of and for the exclusive use of the person or entity (client) named on such report. Results, reports or copies of same will not be released by SGSFL to any third party without prior written request from client. This report applies only to the sample(s) tested. Supporting laboratory documentation is available upon request. This report must not be reproduced except in full, unless approved by SGSFL. The client is solely responsible for the use and interpretation of test results and reports requested from SGSFL. This report must not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. Government. SGSFL is not able to assess the degree of hazard resulting from materials analyzed. SGS Forensic Laboratories reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified. All samples were received in acceptable condition unless otherwise noted.



Report for:

**EPK Glendale**  
**Titan Environmental Solutions, Inc.**  
1521 East Orangethorpe Ave, Ste B  
Fullerton, CA 92831

---

Regarding: Eurofins EPK Built Environment Testing, LLC  
Project: 118291-AS; 44501 5th Street, Lancaster, CA 93535  
EML ID: 3497202

Approved by:

Dates of Analysis:  
Asbestos PLM: 01-03-2024



Approved Signatory  
Roshanak Kalantari

Service SOPs: Asbestos PLM (EPA 40CFR App E to Sub E of Part 763 & EPA METHOD 600/R-93-116, SOP EM-AS-S-1267)  
NVLAP Lab Code 200945-0

---

All samples were received in acceptable condition unless noted in the Report Comments portion in the body of the report. The results relate only to the samples as received and tested. The results include an inherent uncertainty of measurement associated with estimating percentages by polarized light microscopy. Measurement uncertainty data for sample results with >1% asbestos concentration can be provided when requested.

Eurofins EPK Built Environment Testing, LLC ("the Company"), a member of the Eurofins Built Environment Testing group of companies, shall have no liability to the client or the client's customer with respect to decisions or recommendations made, actions taken or courses of conduct implemented by either the client or the client's customer as a result of or based upon the Test Results. In no event shall the Company be liable to the client with respect to the Test Results except for the Company's own willful misconduct or gross negligence nor shall the Company be liable for incidental or consequential damages or lost profits or revenues to the fullest extent such liability may be disclaimed by law, even if the Company has been advised of the possibility of such damages, lost profits or lost revenues. In no event shall the Company's liability with respect to the Test Results exceed the amount paid to the Company by the client therefor.

Client: Titan Environmental Solutions, Inc.  
C/O: EPK Glendale  
Re: 118291-AS; 44501 5th Street, Lancaster, CA  
93535

Date of Sampling: 01-03-2024  
Date of Receipt: 01-03-2024  
Date of Report: 01-03-2024

## ASBESTOS PLM REPORT

**Total Samples Submitted:** 5

**Total Samples Analyzed:** 5

**Total Samples with Layer Asbestos Content > 1%:** 0

### Location: 0103-13-39, South end/TLO office/wall/light switch plaster

Lab ID-Version‡: 17061560-1

Sample Layers	Asbestos Content
White Skim Coat	ND
Gray Plaster	ND
<b>Sample Composite Homogeneity:</b>	Moderate

### Location: 0103-13-40, East end/TLO crafts/wall/light switch plaster

Lab ID-Version‡: 17061561-1

Sample Layers	Asbestos Content
White Skim Coat	ND
Gray Plaster	ND
<b>Sample Composite Homogeneity:</b>	Moderate

### Location: 0103-13-41, North end/women's restroom/wall/light switch plaster

Lab ID-Version‡: 17061562-1

Sample Layers	Asbestos Content
White Skim Coat	ND
Gray Plaster	ND
<b>Sample Composite Homogeneity:</b>	Moderate

### Location: 0103-13-42, North end/maintenance room/wall/light switch plaster

Lab ID-Version‡: 17061563-1

Sample Layers	Asbestos Content
White Skim Coat	ND
Gray Plaster	ND
<b>Sample Composite Homogeneity:</b>	Moderate

The test report shall not be reproduced except in full, without written approval of the laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. The Company reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

‡ A "Version" indicated by "-x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".

Client: Titan Environmental Solutions, Inc.  
C/O: EPK Glendale  
Re: 118291-AS; 44501 5th Street, Lancaster, CA  
93535

Date of Sampling: 01-03-2024  
Date of Receipt: 01-03-2024  
Date of Report: 01-03-2024

## ASBESTOS PLM REPORT

**Location: 0103-13-43, South end/electrical room/wall/light switch plaster**

Lab ID-Version‡: 17061564-1

Sample Layers	Asbestos Content
White Skim Coat	ND
Gray Plaster	ND
<b>Sample Composite Homogeneity:</b>	Moderate

The test report shall not be reproduced except in full, without written approval of the laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. The Company reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified.

Inhomogeneous samples are separated into homogeneous subsamples and analyzed individually. ND means no fibers were detected. When detected, the minimum detection and reporting limit is less than 1% unless point counting is performed. Floor tile samples may contain large amounts of interference material and it is recommended that the sample be analyzed by gravimetric point count analysis to lower the detection limit and to aid in asbestos identification.

‡ A "Version" indicated by "-x" after the Lab ID# with a value greater than 1 indicates a sample with amended data. The revision number is reflected by the value of "x".



Project No.:  
Project Name:

Project Address:

Inspector:  
Sample Date:  
Send Results to:  
Analysis:

118291-AS, XRF  
Per client BV 12/19/23

11829-AS, XRF

El Dorado Park Renovation

44501 5<sup>th</sup> St., Lancaster, CA 93535

Chris Kim  
12/18/23

RESULTS.SOCAL@TITAN-ENVIRO.COM

PLM Bulk Asbestos Analysis by EPA 600/R-93/116 / Other:

# Asbestos Chain of Custody

## Special Instructions:

- ☒ Analyze all wall system samples; Stop at first positive (>1%) for all single layer, homogenous materials (D)
- ☐ Stop at first positive (>1%) for ALL wall system samples and/or single layer, homogenous materials (G)
- ☐ Analyze ALL samples.
- ☐ Other:
- TAT: 3 hr / 6 hr / 24 hr / Other: 4 day
- ☐ Occupied
- ☒ Unoccupied

Sample Number	Sample Location	Material Description	Material Locations	Quantity
1218-01 01	Center - W. wall - Crafts	4" dark gray cove base	Lower walls Tlo	40s.f.
02	E. end - S. wall - office		crafts, office, storage	
03	Center - S. wall - storage			
		Texture/Pattern		
		Assembly/Layers		
		Friable / <u>Non-Friable</u>		
		TSI / Surf / <u>Misc.</u>		
		Condition: <u>G</u> / D / SD		
1218-02 04	Center - W. wall - Crafts	off-white cove base	Lower walls Tlo	40s.f.
05	E. end - S. wall - Office	adhesive	crafts, office, storage	
06	Center - S. wall - storage			
		Texture/Pattern		
		Assembly/Layers		
		Friable / <u>Non-Friable</u>		
		TSI / Surf / <u>Misc.</u>		
		Condition: <u>G</u> / D / SD		
1218-03 07	Center - N wall - Preschool	white Stucco w/ texture	Tlo exterior walls	1500s.f.
08	W. end - N. wall - Preschool			
09	N. end - E. wall -			
10	W. end - S. wall -			
11	Center - S. wall -			
		Texture/Pattern		
		Assembly/Layers		
		Friable / <u>Non-Friable</u>		
		TSI / Surf / <u>Misc.</u>		
		Condition: <u>G</u> / D / SD		

Relinquished (sign):

Received by Lab (sign):

Name (print):

Name (print):

Date/Time:

Date/Time:

☒ Secure Dropbox

☐ Secure Courier Service

CORPORATE ADDRESS: 1521 EAST ORANGETHORPE AVENUE, SUITE B, FULLERTON, CA 92831 \* PHONE: 888-948-4826

Page 1 of 4

Sample Number		Sample Location	Material Description	Material Locations	Quantity
1218-04	12	S. ceiling - crafts room	white 12"x12" ceiling tile	ceilings of crafts	650s.f.
	13	Center ceiling -	(no mastic)	office	
	14	N. ceiling - office			
			Assembly/Layers CK 12.18.23		
			Friable / <del>Non-Friable</del>		
			TSI / Surf / (Misc.)		
			Condition: (G) / D / SD		
1218-05	15	Center floor - men's bathroom	gray floor coating	Men & Women's bathroom	400s.f.
	16	↓		floor	
	17	Center floor - women's bathroom			
			Assembly/Layers		
			Friable / <del>Non-Friable</del>		
			TSI / Surf / (Misc.)		
			Condition: (G) / D / SD		
1218-06	18	Center floor - crafts	2'x4' ceramic floor tile	Tlo crafts, office, &	800s.f.
	19	E. floor - office	(under VFT)	storage floors	
	20	Center floor - storage			
			Assembly/Layers		
			Friable / <del>Non-Friable</del>		
			TSI / Surf / (Misc.)		
			Condition: (G) / D / SD		



Sample Number		Sample Location	Material Description	Material Locations	Quantity
1218-07	21	Center floor - crafts	Size/Color floor tile mastic	Tlo floors under tiles	800sf
	22	E. floor - office	Material	of crafts, office, & storage	
	23	↓ - ↓	Texture/Pattern		
			Assembly/Layers		
			Friable / <u>Non-Friable</u>		
			TSI / Surf / <u>Misc.</u>		
			Condition: <u>G</u> / D / SD		
1218-08	24	SW. roof - crafts/office/storage	Size/Color foam roof core w/ white texture	SW corner roof	200sf
	25	↓ - ↓ roof	Material coat	of crafts, office, & storage	
	26	↓ - ↓ ↓	Texture/Pattern		
			Assembly/Layers		
			Friable / <u>Non-Friable</u>		
			TSI / Surf / <u>Misc.</u>		
			Condition: <u>G</u> / D / SD		
1218-09	27	Center roof - roof penetration	Size/Color Black roof penetration mastic	Tlo roof penetrations	509.6
	28	N. roof - ↓	Material		
	29	S. roof - ↓	Texture/Pattern		
			Assembly/Layers		
			Friable / <u>Non-Friable</u>		
			TSI / Surf / <u>Misc.</u>		
			Condition: <u>G</u> / D / SD		

Sample Number		Sample Location	Material Description	Material Locations	Quantity
1218-10	30	E. roof - ROOF of bldg.	BUR <sup>Size/Color</sup> roof core w/gravel	T/G roof except	650sf
	31	Center roof -	<sup>Material</sup>	foam core	
	32	S. roof -	<sup>Texture/Pattern</sup>		
			<sup>Assembly/Layers</sup>		
			Friable / <u>Non-Friable</u>		
			TSI / Surf / <u>Misc.</u>		
			Condition: <u>G</u> / D / SD		
1218-11	33	N. end - W. wall - Men's RR	white wall <sup>Size/Color</sup> tile - 6x6"	select walls in	650sf
	34	↓ - ↓ - ↓	<sup>Material</sup>	bathrooms	
	35	↓ - ↓ - ↓	<sup>Texture/Pattern</sup>		
			<sup>Assembly/Layers</sup>		
			Friable / <u>Non-Friable</u>		
			TSI / Surf / <u>Misc.</u>		
			Condition: <u>G</u> / D / SD		
1218-12	36	Center - floor - Men's RR	brown <sup>Size/Color</sup> floor tile (bathrooms)	select floors in	100sf
	37	↓ - ↓ - ↓	<sup>Material</sup>	bathrooms	
	38	↓ - ↓ - ↓	<sup>Texture/Pattern</sup>		
			<sup>Assembly/Layers</sup>		
			Friable / <u>Non-Friable</u>		
			TSI / Surf / <u>Misc.</u>		
			Condition: <u>G</u> / D / SD		



Project No.:

Project Name:

Project Address:

Inspector:

Sample Date:

Send Results to:

Analysis:

118291-AS

El Dorado Park Renovation

44501 5th Street, Lancaster, CA 93635

Jared San Antonio

1-03-23

RESULTS.SOCAL@TITAN-ENVIRO.COM

PLM Bulk Asbestos Analysis by EPA 600/R-93/116 / Other:

## Special Instructions:

☐ Analyze all wall system samples; Stop at first positive (single layer, homogenous materials (D)☒ Stop at first positive (>1%) for ALL wall system samples and/or single layer, homogenous materials (G)☐ Analyze ALL samples.☐ Other:

TAP: 3 hr / 6 hr / 24 hr / Other:

Asbestos Ch



003497202

☐ Occupied☒ Unoccupied

Sample Number	Sample Location	Material Description	Material Locations	Quantity
0103.13	39	South End / TLO Office / Wall / Light Switch	NA / White & gray	Within TLO Crafts, office,
	40	East End / TLO Crafts / Wall / Light Switch	Plaster	Storage, Maintenance,
	41	North End / Women's Restroom / Wall / Light Switch	Smooth / NA	Electrical, Women's Restroom,
	42	North End / Maintenance Room / Wall / Light Switch	NA / NA	& Men's Restroom
	43	South End / Electrical Room / Wall / Light Switch	Friable / Non-Friable	
		TSI / Surf / Misc.		
		Condition: G / D / SD		
		Size/Color		
		Material		
		Texture/Pattern		
		Assembly/Layers		
		Friable / Non-Friable		
		TSI / Surf / Misc.		
		Condition: G / D / SD		
		Size/Color		
		Material		
		Texture/Pattern		
		Assembly/Layers		
		Friable / Non-Friable		
		TSI / Surf / Misc.		
		Condition: G / D / SD		

Relinquished (sign):

Received by Lab (sign):

Name (print):

Name (print):

Date/Time:

Date/Time:

☒ Secure Dropbox☐ Secure Courier Service

CORPORATE ADDRESS: 1521 EAST ORANGETHORPE AVENUE, SUITE B, FULLERTON, CA 92831 \* PHONE: 888-948-4826

Jennifer Timmons

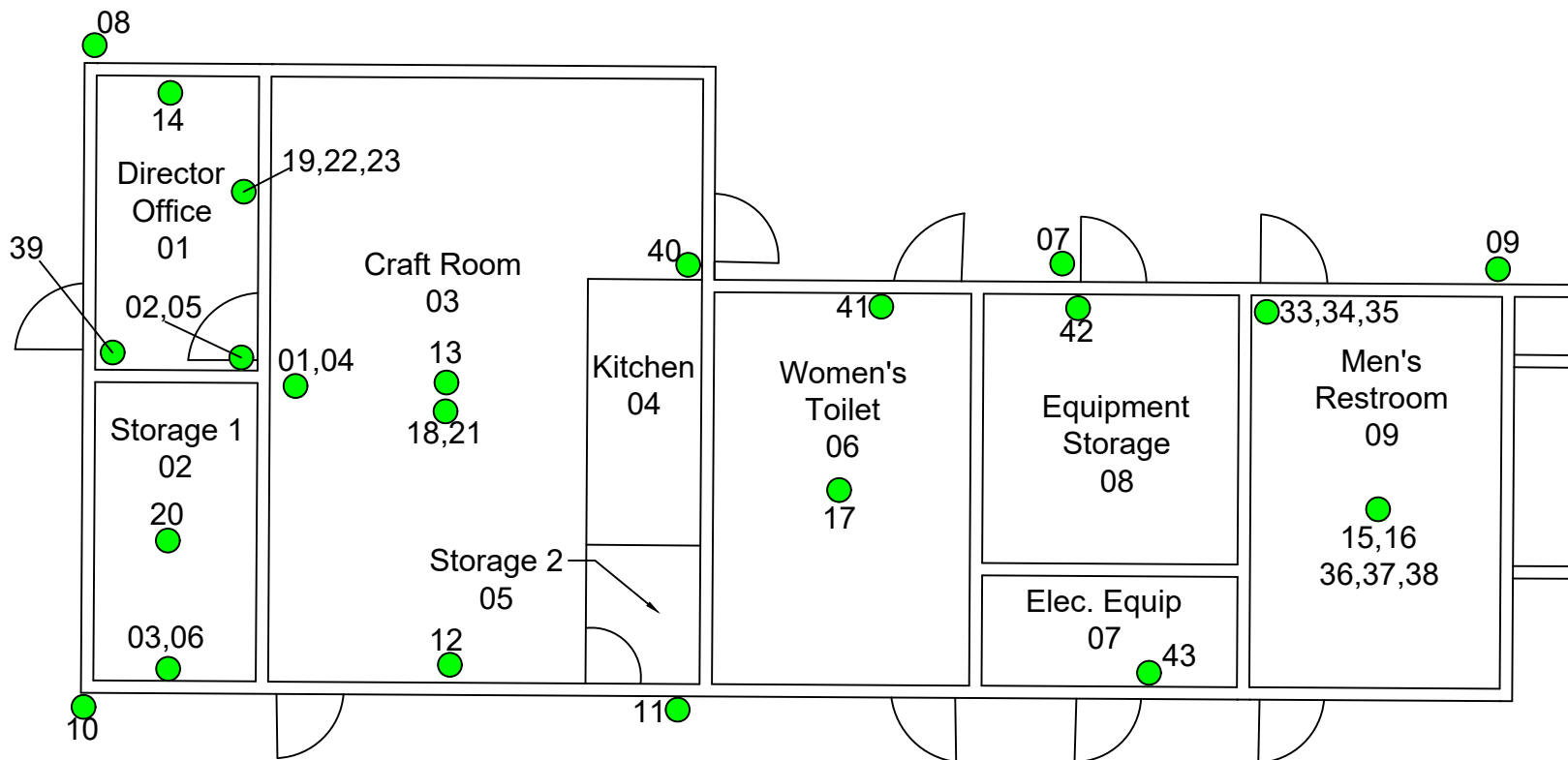
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Revised COC received 1/3/23 16:31

Page 1 of 1



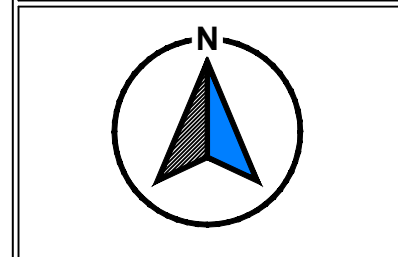
## **ATTACHMENT II**

### **CAD FLOOR PLAN DRAWINGS**



NOTES:

LEGEND:  
 ● ASBESTOS SAMPLE LOCATION (POSITIVE)  
 ● ASBESTOS SAMPLE LOCATION (NEGATIVE)



PROJECT NAME:  
El Dorado Park Renovation

ADDRESS:  
44501 5th Street  
Lancaster, CA 93535

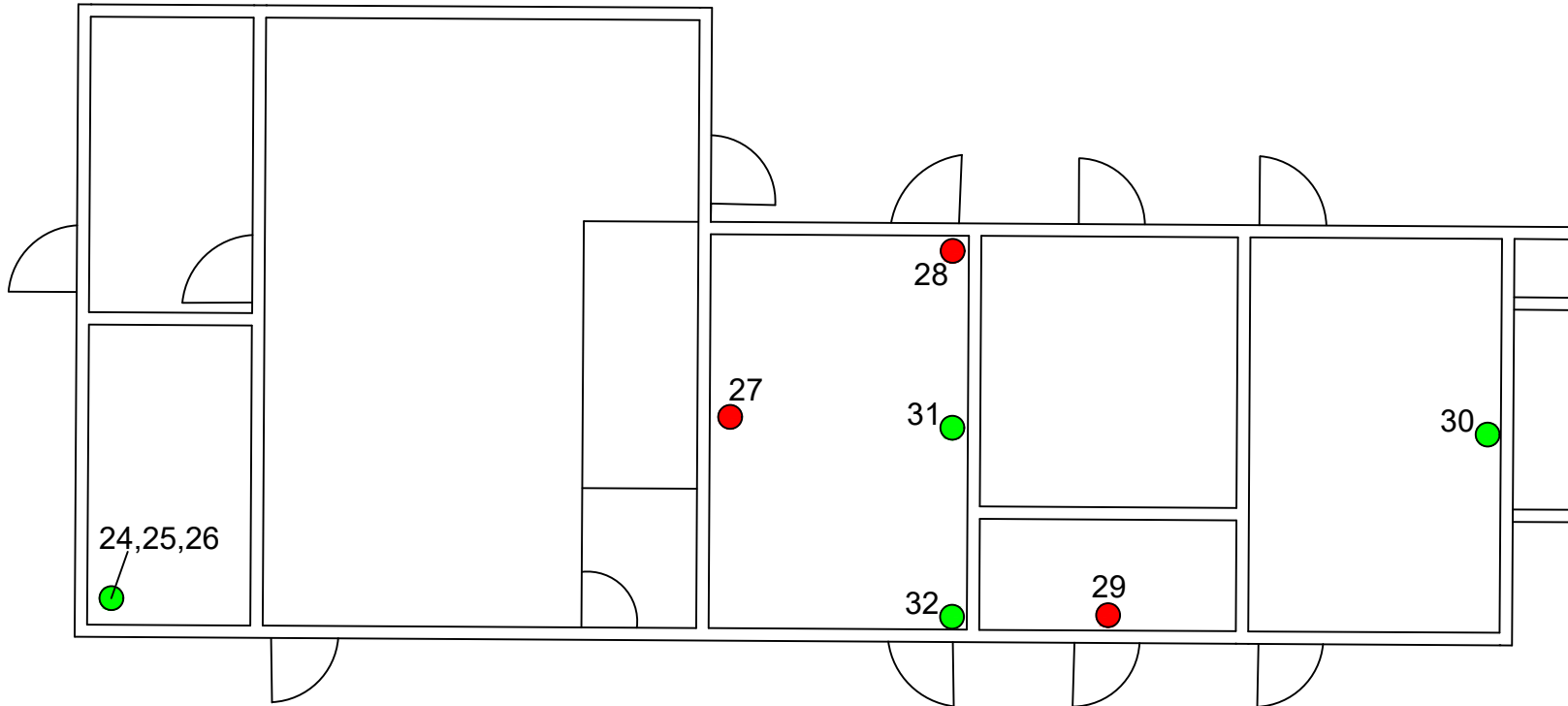
PROJECT NO:	118291
SAMPLE DATE:	12/18/2023
FIGURE NO:	1
REFERENCE:	SITE PLAN



1521 E. Orangethorpe Ave, Suite B  
Fullerton, CA 92831  
Phone: (714) 871-8711



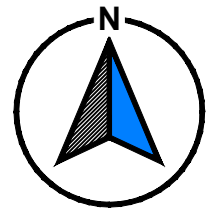
# Roof



NOTES:

LEGEND:

- ASBESTOS SAMPLE LOCATION (POSITIVE)
- ASBESTOS SAMPLE LOCATION (NEGATIVE)



PROJECT NAME:

El Dorado Park Renovation

ADDRESS:

44501 5th Street  
Lancaster, CA 93535

PROJECT NO:	118291
SAMPLE DATE:	12/18/2023
FIGURE NO:	2
REFERENCE:	SITE PLAN



1521 E. Orangethorpe Ave, Suite B  
Fullerton, CA 92831  
Phone: (714) 871-8711



### **ATTACHMENT III**

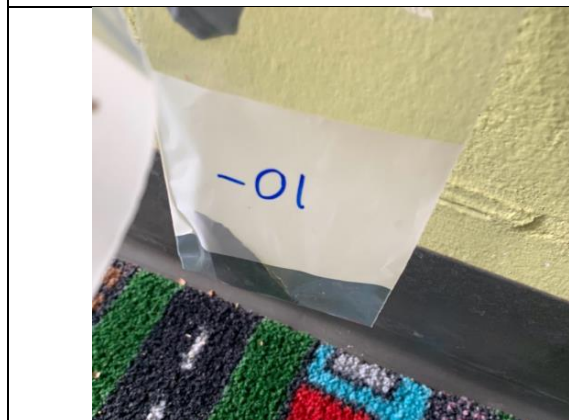
#### **PHOTO LOG**

## Photo Log

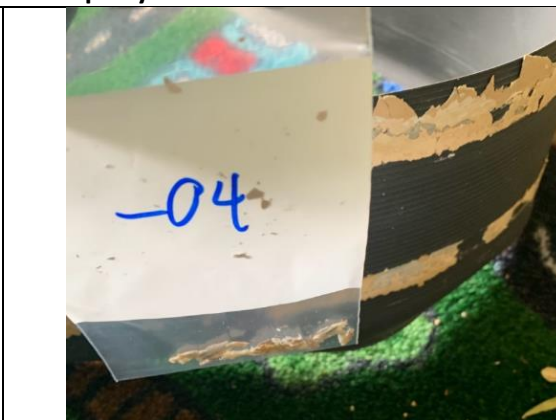
<b>Project Name:</b>	<b>El Dorado Park Renovation</b>
<b>Project Location:</b>	<b>44501 5th Street, Lancaster, CA 93535</b>



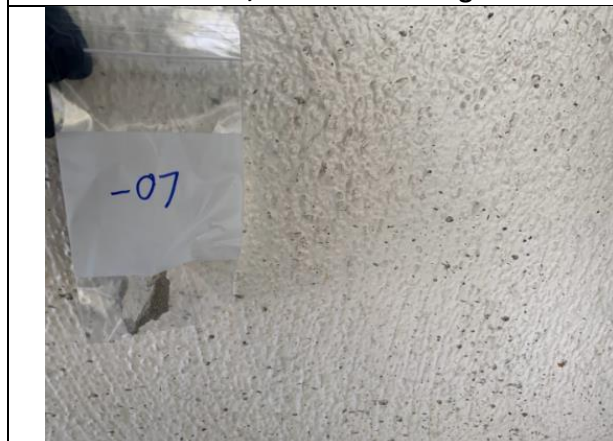
**Photo of Subject Property**



**Photo of HA number 1, Non-ACM Dark Gray 4" Cove Base, within Lower Walls Throughout Crafts Room, Office and Storage**



**Photo of HA number 2, Non-ACM Off-White Cove Base Adhesive, within Lower Walls Throughout Crafts Room, Office and Storage**



**Photo of HA number 3, Non-ACM White Stucco with Texture, Throughout Exterior Walls**



**Photo of HA number 4, Non-ACM White 12"x12" Ceiling Tile (No Mastic), within Ceiling of Crafts Room and Office**



Photo of HA number 5, Non-ACM Gray Floor Coating, within Men's and Women's Bathroom Floor



Photo of HA number 6, Non-ACM - 2'x4' ceramic floor tile (under the VFT)

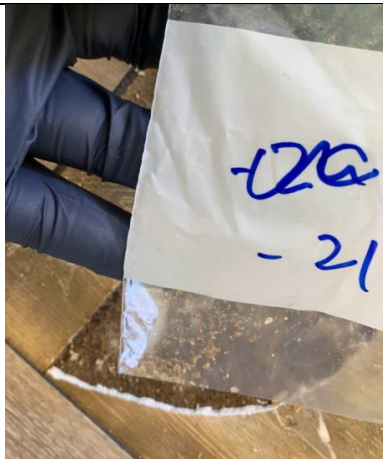


Photo of HA number 7, Non-ACM Floor Tile Mastic, Throughout Floors Under Tiles of Crafts Room, Office and Storage



Photo of HA number 8, Non-ACM Foam Roof Core with White Texture Coat, Throughout Floors Under Tiles of Crafts Room, Office and Storage



Photo of HA number 9, **ACM** Black Roof Penetration Mastic, Throughout Roof Penetrations



Photo of HA number 10, Non-ACM BUR Roof Core with Gravel, Throughout Roof Except Foam Core





Photo of HA number 11, Non-ACM White 6"x6" Wall Tile, within Select Walls in Bathrooms



Photo of HA number 12, Non-ACM Brown Floor Tile (Bathrooms), within Select Floors in Bathrooms



Photo of HA number 13, Non-ACM Gray Plaster Wall within the Women's Restroom



Photo of HA number 13, Non-ACM Gray Plaster Wall within the Electrical Room



Photo of Reading number 48, **LBP** Ceramic Urinal Wall, within Men's Restroom



Photo of Reading number 65, **LCM** Wood Door, within Women's Restroom





**Photo of Reading number 106, BDL Tan Plaster  
Wall within the Maintenance Room**



**Photo of Reading number 109, BDL Beige Plaster  
Wall within the Storage**



**ATTACHMENT IV**

**INSPECTOR CERTIFICATION(S)**

State of California  
Division of Occupational Safety and Health  
**Certified Site Surveillance Technician**

**Christopher J Kim**



Name

Certification No. **19-6676**

Expires on **01/14/24**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.



STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC HEALTH



# LEAD-RELATED CONSTRUCTION CERTIFICATE

**INDIVIDUAL:**



**Christopher Kim**

**CERTIFICATE TYPE:**

Lead Sampling Technician

**NUMBER:**

LRC-00007403

**EXPIRATION DATE:**

10/11/2024

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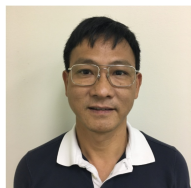


STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC HEALTH



# LEAD-RELATED CONSTRUCTION CERTIFICATE

**INDIVIDUAL:**



**Thai Chu**

**CERTIFICATE TYPE:**

Lead Sampling Technician

**NUMBER:**

LRC-00011860

**EXPIRATION DATE:**

10/17/2024

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State of California  
Division of Occupational Safety and Health  
**Certified Site Surveillance Technician**

**Jared F San Antonio**



Name

Certification No. **12-4888**

Expires on **09/19/24**

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STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC HEALTH



# LEAD-RELATED CONSTRUCTION CERTIFICATE

**INDIVIDUAL:**



**Jared San Antonio**

**CERTIFICATE TYPE:**

Lead Sampling Technician

**NUMBER:**

LRC-00007724

**EXPIRATION DATE:**

11/29/2024

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State of California  
Division of Occupational Safety and Health  
**Certified Asbestos Consultant**

**Robert B Menald**

Name



Certification No. **08-4323**

Expires on **01/17/24**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.



STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC HEALTH



# LEAD-RELATED CONSTRUCTION CERTIFICATE

**INDIVIDUAL:**



**Robert Menald**

**CERTIFICATE TYPE:**

Lead Inspector/Assessor

Lead Project Monitor

**NUMBER:**

LRC-00005260

LRC-00005259

**EXPIRATION DATE:**

2/20/2024

2/20/2024

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at [www.cdph.ca.gov/programs/clppb](http://www.cdph.ca.gov/programs/clppb) or calling (800) 597-LEAD

State of California  
Division of Occupational Safety and Health  
**Certified Asbestos Consultant**

**Ibrahim M Sobeih**

Name



Certification No. **06-4078**

Expires on **10/18/24**

This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7160 et seq. of the Business and Professions Code.





STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC HEALTH



# LEAD-RELATED CONSTRUCTION CERTIFICATE

**INDIVIDUAL:**



**Ibrahim Sobeih**

**CERTIFICATE TYPE:**

Lead Inspector/Assessor

**NUMBER:**

LRC-00011308

**EXPIRATION DATE:**


6/6/2024

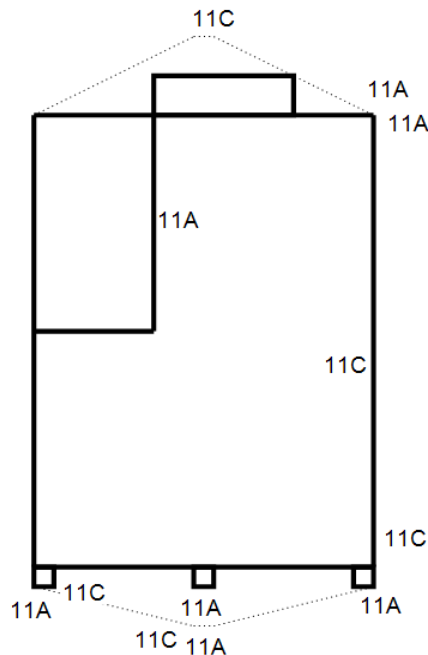
Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at [www.cdph.ca.gov/programs/clppb](http://www.cdph.ca.gov/programs/clppb) or calling (800) 597-LEAD

## APPENDIX C

### TERMITE REPORT (WOOD DESTROYING PESTS AND ORGANISMS INSPECTION REPORT)

# WOOD DESTROYING PESTS AND ORGANISMS INSPECTION REPORT

Building Address: <b>44501 E. 5th St., Lancaster, CA 93535</b>		Date of Inspection <b>12/27/2023</b>	Number of Pages <b>6</b>
 <div style="display: inline-block; text-align: left; margin-left: 20px;"> <b>16635 GAZELEY ST. CANYON COUNTRY CA 91351</b>              TOLL FREE (877) 541 2272 • DIRECT LINE (818) 893 0563  <b>WWW.PESTGUARDEXT.COM</b> </div>			Report # <b>W17950</b>  Lic. Registration # <b>PR 5774</b>  Escrow #
Ordered by: City of Lancaster Frank Lujan 44501 E. 5th St. Lancaster, CA 93535	Property Owner and/or Party of Interest: City of Lancaster Frank Lujan 44501 E. 5th St. Lancaster, CA 93535	Report Sent to: City of Lancaster Frank Lujan 44501 E. 5th St. Lancaster, CA 93535	
COMPLETE REPORT <input checked="" type="checkbox"/> LIMITED REPORT <input type="checkbox"/> SUPPLEMENTAL REPORT <input type="checkbox"/> REINSPECTION REPORT <input type="checkbox"/>			
General Description: <b>SFR, Slab, Tile Roof</b>		Inspection Tag Posted:    Interior  Other Tags Posted: None	
An inspection has been made of the structure(s) shown on the diagram in accordance with the Structural Pest Control Act. Detached porches, detached steps, detached decks and any other structures not on the diagram were not inspected.			
Subterranean Termites <input type="checkbox"/> Drywood Termites <input checked="" type="checkbox"/> Fungus / Dryrot <input checked="" type="checkbox"/> Other Findings <input type="checkbox"/> Further Inspection <input type="checkbox"/> <small>If any of the above boxes are checked, it indicates that there were visible problems in accessible areas. Read the report for the details on checked items.</small>			



This Diagram is not to scale

Inspected by: Luis Romero    State License No. OPR 11670    Signature 

You are entitled to obtain copies of all reports and completion notices on this property reported to the Structural Pest Control Board during the preceding two years. To obtain copies contact: Structural Pest Control Board, 2005 Evergreen Street, Ste. 1500, Sacramento, California 95815.

NOTE: Questions or problems concerning the above report should be directed to the manager of the company. Unresolved questions or problems with the services performed may be directed to the Structural Pest Control Board at (916) 561-8708, (800) 737-8188 or [www.pestboard.ca.gov](http://www.pestboard.ca.gov)

SECOND PAGE OF STANDARD INSPECTION REPORT OF THE PROPERTY LOCATED AT:

Address 44501 E. 5th St., Lancaster, CA 93535

12/27/2023

W17950

Date

Report #

What is a Wood Destroying Pest and Organism Inspection Report?

The following explains the scope and limitations of a structural pest control inspection and a Wood Destroying Pest & Organism Inspection Report.

A Wood Destroying Pest & Organism Inspection Report contains finding as to the presence or absence of wood destroying insects or organisms in visible and accessible areas on the date of inspection and contains our recommendations for correcting any infestations, infections, or conditions found. The contents of the wood destroying pest & organism inspection report are governed by the structural pest control act and its rules and regulations.

Some structures may not comply with building code requirements or may have structural, plumbing, electrical, heating and air conditioning, or other defects that do not pertain to this report. This report does not address any such defects as they are not within the scope of the license of the inspector or the company issuing this report.

The following areas are considered inaccessible for purposes of inspection or are not included in a normal inspection report and therefore are excluded in this report: the interior of hollow walls; spaces between an upstairs floor and the ceiling below or a porch deck and soffit below; stall showers over finished ceilings; such structural segments as areas enclosed by bay windows, buttresses, built in cabinet work, areas under floor covering; any areas requiring the removal of storage, furnishings or appliances; any areas to which there is no access without defacing or removing lumber, masonry or finished workmanship.

Certain areas are recognized by the industry as inaccessible and/or for other reasons not inspected. These include but are not limited to: inaccessible and/or, insulated attics or portions thereof, attics with less than 18" clear crawl space, the interior of hollow walls; spaces between a floor or porch deck and the ceiling below; areas where there is no access without defacing or tearing out lumber, masonry or finished work; make inspection impractical; and areas or timbers around eaves that would require use of an extension ladder.

Certain areas may be inaccessible for inspection due to construction or storage. We recommend further inspection of areas where inspection was impractical. Re: Structural Pest Control Act, Article 6, section 8516 (b), paragraph 1990 (l). Amended effective March 1, 1974. Stall shower, if any, are water tested in compliance with Section 1991 (12) of the Structural Pest Control Act. The absence or presence of leaks through sub-floor, adjacent floors or walls will be reported. This is a report of the condition of the stall shower at the time of inspection only, and should not be confused as a guarantee. Although we make a visual examination, we do not deface or probe into window or door frames, decorative trim, roof members, etc., in search of wood destroying pests or organisms.

This company will reinspect repairs done by others within four months of the original inspection. A charge, if any, can be no greater than the original inspection fee for each reinspection. The reinspection must be done within ten (10) working days of request. The reinspection is a visual inspection and if inspection of concealed areas is desired, inspection of work in progress is necessary. Any guarantees must be received from parties performing repairs.

NOTE: We do not inspect or certify plumbing, plumbing fixtures, etc.

**NOTE: "The exterior surface of the roof was not inspected. If you want the water tightness of the roof determined, you should contract a roofing contractor who is licensed by the Contractor's State License Board."**

"NOTICE: The charge for service that this company subcontracts to another person or entity may include the company's charges for arranging and administering such services that are in addition to the direct costs associated with paying the subcontractor. You may accept Pest Guard Exterminator Company Inc.'s bid or you may contract directly with another registered company licensed to perform the work.

If you choose to contract directly with another registered company, Pest Guard Exterminator Company Inc. will not in any way be responsible for any act or omission in the performance of work that you directly contract with another to perform."

**"NOTICE: Reports on this structure prepared by various registered companies should list the same findings (i.e. termite infestations, termite damage, fungus damage, etc.). However, recommendations to correct these findings may vary from company to company. You have a right to seek a second opinion from another company."**

This Wood Destroying Pest & Organisms Report DOES NOT INCLUDE MOLD or any mold like conditions. No reference will be made to mold or mold-like conditions. Mold is not a Wood Destroying Organism and is outside the scope of this report as defined by the Structural Pest Control Act. If you wish your property to be inspected for mold or mold like conditions, please contact the appropriate mold professional.

"Local treatment is not intended to be an entire structure treatment method. If infestations or wood-destroying pests extend or exist beyond the area(s) of local treatment, they may not be exterminated."

This is a separated report which is defined as Section I/Section II conditions evident on the date of the inspection. Section I contains items where there is visible evidence of active infestation, infection or conditions that have resulted in or from infestation or infection. Section II items are conditions deemed likely to lead to infestation or infection but where no visible evidence of such was found. Further inspection items are defined as recommendations to inspect area(s) which during the original inspection did not allow the inspector access to complete the inspection and cannot be defined as Section I or Section II.

Address 44501 E. 5th St., Lancaster, CA 9353512/27/2023W17950

Date

Report #

---

**FINDINGS AND RECOMMENDATIONS**

---

**Substructure:** Slab

**Stall Shower:** None Tested

**Foundations:** Concrete above grade

**Porches - Steps:** Concrete

**Ventilation:** Adequate above grade

**Abutments:** None

**Attic Spaces:** Good access

**Garages:** Two car attached

**Decks - Patios:** Wood

**Other Interior:** Inspected

**Other Exterior:** Inspected

11A PRICE: \$2,650.00 (Section I)  
FINDINGS: Dry-rot wood members found at time of inspection at exterior as indicated on the diagram.  
RECOMMENDATION: Replace dry-rot damaged wood members as necessary. Roofing material repairs will need to be made by a licensed tradesman after Pest Guard has completed repair work. 1 coat primer painting is included in this estimate. If additional adverse conditions are uncovered during repairs, further inspection will be recommended and a supplemental report will be issued indicating any infection, or additional repairs.

11B PRICE: \$2,500.00 (Section I)  
FINDINGS: Evidence of drywood termite infestations at exterior as indicated on the diagram.  
RECOMMENDATION: Vacate the premises and seal the structure for fumigation with Vikane Gas. Remove or cover accessible evidence of infestation. Fumigation warranted for two years. Fumigation awareness notice must be signed prior to fumigation. See fumigation notice for terms and liabilities.

SECONDARY PRICE: \$1,250.00  
SECONDARY RECOMMENDATION: SECONDARY RECOMMENDATION IN LIEU OF FUMIGATION:  
Chemically treat visible and accessible infestations only. Remove or cover accessible evidence of infestation. This is a sub-standard recommendation. Limited guarantee due to concealed areas not being treated.  
Secondary work requested by \_\_\_\_\_.



Address 44501 E. 5th St., Lancaster, CA 93535

12/27/2023

W17950

Date \_\_\_\_\_

Report #

11C PRICE: See 11A (Section I)  
FINDINGS: Surface fungus condition visible at time of inspection at exterior as indicated on the diagram.  
RECOMMENDATION: Scrape and chemically treat fungus condition. Patch any minor surface damage found during treatment.

"State law requires that you be given the following information: CAUTION, PESTICIDES ARE TOXIC CHEMICALS. Structural Pest Control Companies are registered and regulated by the Structural Pest Control Board, and apply pesticides which are registered and approved for use by the California Dept. of Pesticide Regulation and the United States Environmental Protection Agency. Registration is granted when the State finds that based on existing scientific evidence there are no appreciable risks if proper use conditions are followed or that the risks are outweighed by the benefits. The degree of risk depends upon the degree of exposure, so exposure should be minimized."

For further information, contact any of the following:

Pest Guard Exterminator Company Inc. (877) 541-2272

Poison Control Center (800) 876-4766

(Health Questions) County Health Dept.	
Orange County	(714) 834-7700
Los Angeles County	(213) 250-8055
San Bernardino County	(909) 387-6280
Riverside County	(909) 358-5000

(Application Info.) County Agriculture Commission	
Orange County	(714) 447-7100
Los Angeles County	(626) 575-5466
San Bernardino County	(909) 387-2115
Riverside County	(951) 955-3000

Structural Pest Control Board (Regulatory Info.) (916) 561-8704  
2005 Evergreen St. #1500 Sacramento Ca 95815

## TERMITE AND FUNGUS CONTROL CHEMICALS

Vikane (EPA Reg. No. 62719-4)  
Active Ingredients: Vikane-sulfuryl fluoride 99.5%, Chloropicrin .5%  
Tim-bor (Disodium Octaborate Tetrahydrate 98% EPA # 1624-39)

Dragnet SFR (EPA Reg. No. 279-3062)  
Active Ingredients: Permethrein (3-Phenoxyphenyl)methyl+-Cis-trans 3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate

Invader HPX-20 (EPA Reg. No. 9444-204)  
Active Ingredients: Propoxur 1%

Tim-bor (EPA Reg. No. 1624-39)  
Active Ingredients: Disodium Octaborate Tetrahydrate 98%

FIFTH PAGE OF STANDARD INSPECTION REPORT OF THE PROPERTY LOCATED AT:

Address 44501 E. 5th St., Lancaster, CA 93535

12/27/2023

W17950

Date

Report #

NOTICE TO OWNER

Under the California Mechanic's Lien Law any structural pest control company which contracts to do work for you, any contractor, subcontractor, laborer, supplier or other person who help to improve your property, but is not paid for his work or supplies, has the right to enforce a claim against your property. This means that after a court hearing, your property could be sold by a court officer and the proceeds of the sale used to satisfy the indebtedness. This can happen even if you have paid your structural pest control company in full if the sub-contractor, laborers, or suppliers remain unpaid. To preserve their right to file a claim of lien against your property, certain claimants such as subcontractors or material suppliers are required to provide you with a document entitled "Preliminary Notice". Prime contractors and laborers for wages do not have to provide this notice. A Preliminary Notice is not a lien against your property. Its purpose is to notify you of persons who may have a right to file a lien against your property if they are not paid.

NOTE: If the Home Owner fails to pay billing in full, Pest Guard Exterminator Company Inc. will have the right to be paid back for all its costs and expenses to the extent not prohibited by applicable law. Those expenses include, for example (but not limited to), reasonable attorney's fees. If for any reason this account is to be turned over to our collection agency, You will be responsible for all cost of collecting.

## SIXTH PAGE OF STANDARD INSPECTION REPORT OF THE PROPERTY LOCATED AT:

Address 44501 E. 5th St., Lancaster, CA 9353512/27/2023W17950

Date

Report #

**Findings and Recommendations estimated by this Company:**

Item	Approval	Primary Estimate	Approval	Secondary Recommendation Estimate	Section
11A	<input type="checkbox"/>	\$2,650.00			I
11B	<input type="checkbox"/>	\$2,500.00	<input type="checkbox"/>	\$1,250.00	I
11C	<input type="checkbox"/>	Included in 11A			I

☐ Complete all of the items quoted above with Primary Estimate.**Total Estimate \$5,150.00**☐ Complete all of the items quoted above substituting Primary Estimate with Secondary Estimate where applicable.**Total Estimate \$3,900.00**☐ Complete only the above Items checked.

Total \$ \_\_\_\_\_

*I have read and understand the terms of the Report referenced above and agree to the terms and conditions set forth.**Pest Guard Exterminator Company Inc. is hereby authorized to complete the Items selected above and it is agreed that payment shall be made as follows:*Payment shall be made as follows: ☐ With close of Escrow ☐ \$ \_\_\_\_\_ Deposit ☐ \$ \_\_\_\_\_ on Completion

Escrow Number: \_\_\_\_\_ Escrow Company: \_\_\_\_\_ Escrow Officer: \_\_\_\_\_

Phone ( ) \_\_\_\_\_ - \_\_\_\_\_ Email: \_\_\_\_\_ Address: \_\_\_\_\_

Owner or Authorized Representative: ☐ Owner ☐ Representative's Title: \_\_\_\_\_

Print Name: \_\_\_\_\_ X \_\_\_\_\_ Date \_\_\_\_\_

Owner or Authorized Representative: ☐ Owner ☐ Representative's Title: \_\_\_\_\_

Print Name: \_\_\_\_\_ X \_\_\_\_\_ Date \_\_\_\_\_

## APPENDIX D

### CALIFORNIA STORMWATER QUALITY ASSOCIATION STORMWATER BEST MANAGEMENT PRACTICE HANDBOOK



California Stormwater Quality Association

**Stormwater Best Management Practice**

# Handbook

M u n i c i p a l

New Development  
and Redevelopment



Construction



Industrial  
and Commercial



Municipal





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# Acknowledgements

The Stormwater Best Management Practice Handbooks are products of the California Stormwater Quality Association (CASQA). The handbooks were originally published in 1993 by the California Stormwater Quality Task Force (SWQTF), the predecessor of CASQA. As part of this project, the original handbooks have been updated to reflect the current state of stormwater quality management practices and to make the handbook accessible via the Internet at [www.cabmphandbooks.com](http://www.cabmphandbooks.com).

CASQA is a nonprofit public benefit corporation and is not organized for private gain of any person. It is organized under the Nonprofit Public Benefit Corporation Law of California for charitable and educational purposes. The specific purpose of CASQA is to assist those entities charged with stormwater quality management responsibilities with the development and implementation of stormwater quality goals and programs. CASQA serves its members through various educational, technical, and scientific initiatives. The publication of the Stormwater Best Management Practice Handbooks is one of CASQA's educational and technical initiatives.

This project was funded through contributions from public agencies throughout California, whose support made the handbooks possible. Contributing agencies include:

## State Agencies

California Department of  
Transportation

California State Water Resources  
Control Board

## County Agencies

Alameda County

Contra Costa County

Los Angeles County

Marin County

Orange County

Sacramento County

Santa Barbara County

Santa Clara County

San Diego County

San Mateo County

Siskiyou County

## Municipalities

City of Bakersfield

City of Carmel

City of Fairfield

City of Lodi

City of Long Beach

City of Modesto

City of Monterey

City of Sacramento

City of San Diego

City of Santa Rosa

City of Stockton

City of Visalia

City of Watsonville

City of Woodland

## **Special Districts**

Fresno Metropolitan Flood Control District

Port of San Diego

Riverside County Flood Control and Water Conservation District

San Bernardino County Flood Control District

Vallejo Sanitation and Flood Control District

Ventura County Flood Control District

The development of the Stormwater Best Management Practice Handbooks was guided by a Steering Committee, a Technical Advisory Committee, and the CASQA BMP Workgroup. The Steering Committee provided CASQA's direction to the Consultant. The Steering Committee included representatives from Phase I communities, special districts, regulatory agencies, and consulting. The Technical Advisory Committee and BMP Workgroup reviewed draft work products and provided comments to the Steering Committee. The Technical Advisory Committee included representatives from Phase I communities, Phase II communities, regulatory agencies (water quality and health), academia, industry, transportation, and consulting. The quality of the handbooks is a result of the diverse expertise and experience of the committees and the workgroup.

## **Steering Committee**

Scott Taylor, Committee Chair, RBF Consulting

Bruce Fujimoto, California State Water Resources Control Board

Naresh Varma, San Bernardino County Flood Control District

Karen Ashby, Orange County Public Facilities and Resources Department

Steve Stump, Riverside County Flood Control and Water Conservation District

Bill Busath, City of Sacramento

Mark Wills, Riverside County Flood Control and Water Conservation District

Melinda Marks, Fresno Metropolitan Flood Control District

## **Technical Advisory Committee**

Scott Taylor, Committee Chair, RBF Consulting

John Johnston, California State University Sacramento Faculty Member

Karen Henry, City of San Diego

Jennifer Gonzalez, City of Monterey

Xavier Swamikannu, Los Angeles Regional Water Quality Control Board

Tim Piasky, Building Industry Association and Associated General Contractors

Marco Metzger, California Department of Health Services

Dan Barber, Concrete Industries

Jerry Marcotte, California Department of Transportation

U.S. Environmental Protection Agency

The County of San Bernardino and San Bernardino County Flood Control District, under the direction of Naresh Varma, Chief, Environmental Management Division, provided financial and contract management services on behalf of the California Stormwater Quality Task Force and the California Stormwater Quality Association for the update and revision of the Stormwater Best Management Practice Handbooks.

The Stormwater Best Management Practice Handbooks were prepared by the Camp Dresser & McKee Inc. (CDM) and Larry Walker Associates (LWA) team. The CDM-LWA team was led by Jeff Endicott, CDM Officer-in-Charge and Project Manager, and Mack Walker, LWA Project Manager. The handbook team included the following consultants and individuals:

## **Consultant Team**

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Janelle Rogers, Ph.D., P.E. (WA) Assistant Project Manager

Don Schroeder, P.E.

Luis Leon, P.E.

Stephen Liao, P.E.

Brendan Boyd

Tracy Gaudino

Basheera Raheem-Streetz

### **Larry Walker Associates**

Mack Walker, P.E., Handbook Project Manager

Heather Kirschmann



## *Acknowledgements*

Erich Simon

Dean Messer, Ph.D.

### **Catalyst**

Tom Richman, ASLA, AICP

**Mike Barrett, Ph.D., P.E. (TX)**

**Geoff Brosseau**

**Gary Minton, Ph.D., P.E. (WA)**

### **Disclaimer**

The California Stormwater Quality Handbooks are intended to provide a range of general information about stormwater quality best management practices (BMPs) and related issues. Due to the multitude of applications of BMPs, the Handbooks do not address site-specific applications. Therefore, users of the Handbooks must seek advice of a stormwater quality professional to determine the applicability of the information provided for any general use or site-specific application. Users of the Handbooks assume all liability directly or indirectly arising from use of the Handbooks.

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# Section 1

## Introduction

Stormwater runoff is part of a natural hydrologic process. Human activities particularly urbanization and agriculture, can alter natural drainage patterns and add pollutants to rivers, lakes, and streams as well as coastal bays, estuaries, and ultimately, the ocean. Numerous studies have shown urban runoff to be a significant source of water pollution, causing declines in fisheries, restricting swimming, and limiting our ability to enjoy many of the other benefits that water resources provide (USEPA, 1992). Urban runoff in this context includes all flows discharged from urban land uses into stormwater conveyance systems and receiving waters and includes both dry weather non-stormwater sources (e.g., runoff from landscape irrigation, water line and hydrant flushing) and wet weather stormwater runoff. In this handbook, urban runoff and stormwater runoff are used interchangeably.

For many years, the effort to control the discharge of stormwater focused mainly on the quantity (e.g. drainage, flood control) and, only to a limited extent, on the quality of the stormwater (e.g. sediment and erosion control). In recent years, however, awareness of the need to improve water quality has increased. With this awareness, federal, state, and local programs have been established to reduce pollutants contained in stormwater discharges to our waterways. The emphasis of these programs is to promote the concept and the practice of preventing pollution at the source, before it can cause environmental problems (USEPA, 1992). Where further controls are needed, treatment of polluted runoff may be required.

### 1.1 Handbook Purpose and Scope

The purpose of this handbook is to provide general guidance for selecting and implementing Best Management Practices (BMPs) to reduce pollutants in runoff from municipal operations. Federal and state programs require selected municipalities to reduce the discharge of pollutants in their stormwater discharges to the maximum extent practicable (MEP) using an array of control measures including BMPs. It is not the intent of this handbook to dictate the actual selection of BMPs (this will be done by the municipality), but rather to provide the framework for an informed selection of BMPs for the program.

Although MEP has not been defined by the federal regulations, the use of this handbook and the selection process presented herein should assist municipalities in achieving MEP. In selecting BMPs that will achieve MEP, it is important to remember that municipalities will be responsible to reduce the discharge of pollutants in stormwater to the maximum extent practicable. The following factors should be considered in deciding if a BMP is practicable:

- Pollutant Removal - Will the BMP remove (or control) the pollutant(s) of concern?
- Regulatory Compliance - Is the BMP compatible with stormwater regulations as well as other regulations for air, hazardous wastes, solid waste disposal, groundwater protection, etc.?
- Public Acceptance - Does the BMP have public support?



- Implementation - Is the BMP compatible with land uses, facilities, or activities in question?
- Cost - Will the cost for implementing the BMP significantly exceed the pollution control benefits? Does a revenue stream exist for ongoing maintenance?
- Technical Feasibility - Is the BMP technically feasible considering soils, geography, water resources, etc.?

Ultimately, the municipality must implement and maintain the selected BMPs and prepare and adhere to a schedule for implementation and maintenance.

### **1.1.1 Users of the Handbook**

This handbook is primarily designed to assist municipal staff with incorporating pollution prevention controls into their overall stormwater management program and specifically publicly owned/operated facilities (fixed facilities) and field activities (field programs). Users include public and private sector engineers, planners, environmental specialists, and stormwater program managers. Managers and employees of the various municipal facilities and municipal field programs may find this handbook especially helpful when implementing and evaluating the effectiveness of these stormwater management efforts.

### **1.1.2 Organization of the Handbook**

The handbook is organized to assist the user in selecting and implementing best management practices to reduce impacts of stormwater discharges on receiving waters. The handbook consists of the following sections:

**Section 1  
Introduction**

*This section provides a general review of the sources and impacts of municipal stormwater discharges and provides an overview of the federal and state programs regulating stormwater discharges.*

**Section 2  
Stormwater Pollution Prevention Planning for Municipal Operations**

*This section describes a process to follow in identifying and selecting BMPs for pollutant generating activities.*

**Section 3  
Source Control BMPs**

*BMP fact sheets presented in this section address BMPs (or procedures) to control or eliminate sources of stormwater pollutants. These BMPs should be considered in all efforts to reduce pollutants from municipal operations*

**Section 4  
Treatment Control BMPs**

*BMP fact sheets presented in this section address BMPs that remove pollutants from runoff (treatment controls). These fact sheets focus on the maintenance requirements of these controls.*

**Section 5  
BMP Implementation and Evaluation**

*This section outlines development of a program to monitor BMP effectiveness and evaluate additional BMP requirements. Topics include site inspections, BMP monitoring, recordkeeping, and BMP review/modifications.*

**Section 6  
Glossary and List of Acronyms**

*This section identifies terms and abbreviations used in the handbooks.*

**Appendix A  
Inventory of Municipal Operations**

*This appendix provides an example of an inventory of municipal operations that may be sources of pollutants in stormwater runoff.*

**Appendix B  
Assessment of Municipal Operations**

*This appendix provides an example worksheet for assessing fixed facilities to determine the level of BMP implementation.*

**Appendix C  
BMP Selection Process**

*This appendix provides an example of BMP selection for a fixed facility.*

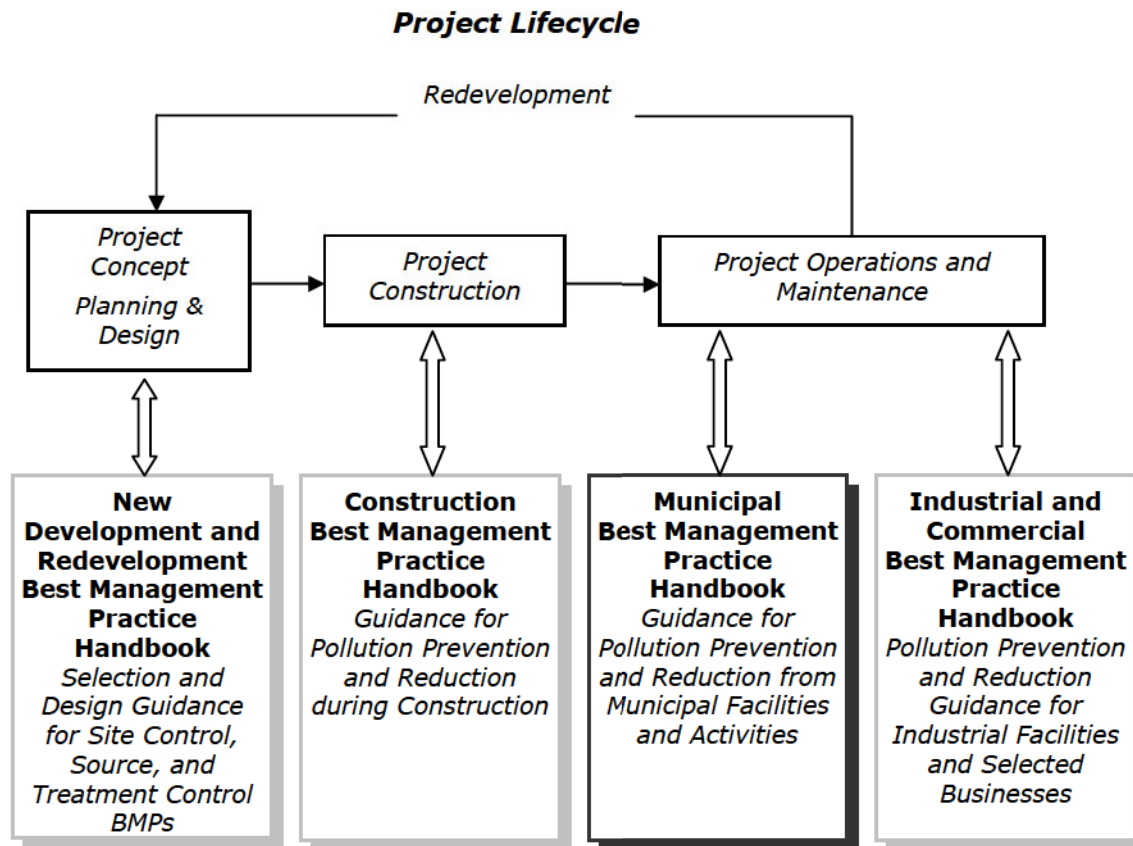
**Appendix D  
Contract/Lease Agreement**

*This appendix provides example lease language for fixed facilities.*

### 1.1.3 Relationship to Other Handbooks

This handbook is one of four handbooks developed by the California Stormwater Quality Associations (CASQA) to address BMP selection. Collectively, the four handbooks address BMP selection throughout the life of a project, from planning and design through construction and into operation and maintenance. Individually, each handbook is geared to a specific target audience during each stage of a project.





This handbook, the Municipal Handbook, provides information primarily for municipalities to use in selecting and implementing control measures for municipal operations including fixed facilities and field programs. In this context, information provided in Section 4, Treatment Control BMPs, is focused on maintenance requirements for existing treatment control BMPs. If a new treatment control BMP is being considered at an existing or new municipal facility, the reader is referred to the New Development and Redevelopment Handbook.

For a comprehensive understanding of stormwater pollution controls throughout the life cycle of development, it is recommended that the readers obtain and become familiar with all four handbooks. Typically, municipal stormwater program managers, regulators, environmental organizations, and stormwater quality professionals will have an interest in all four handbooks. For a focused understanding of stormwater pollution control during a single phase of the project life cycle, a reader may obtain and become familiar with the handbook associated with the appropriate phase. Typically, contractors, construction inspectors, industrial site operators, commercial site operators, some regulators, and some municipal staff may have an interest in a single handbook.

## 1.2 Stormwater Pollutants and Impacts on Water Quality

Stormwater runoff naturally contains numerous constituents; however, urbanization and urban activities (including municipal activities) typically increase constituent concentrations to levels that may impact water quality. Pollutants associated with stormwater include sediment, nutrients, bacteria and viruses, oil and grease, metals, organics, pesticides, and gross pollutants (floatables). In addition, nutrient-rich stormwater runoff is an attractive medium for vector production when it accumulates and stands for more than 72 hours. Stormwater pollutants are described in Table 1-1.

### Municipal Activities Generating Pollutants

Municipalities conduct various activities that are sources of pollutants in stormwater runoff. For the purpose of this handbook, these activities are categorized according to whether they occur at a specific location (fixed facility) or across a broader and non-specific area (field programs). Some of these activities are summarized in the list below. All activities are discussed in more detail in Section 2. These activities must be addressed through the implementation of BMPs to minimize or eliminate the pollutants from entering the local water bodies or drainage system.

#### Typical Municipal Operations that Generate Pollutants

##### **Fixed Facilities Activities**

Building Maintenance & Repair

Parking Lot Maintenance

Landscape Maintenance

Waste Handling and Disposal

Vehicle Fueling and Storage Tank Filling

Equipment Maintenance & Repair

Vehicle and Equipment Storage

Vehicle and Equipment Cleaning

Material Handling & Storage

Material Loading & Unloading

Minor Construction

Over Water Activities

##### **Field Program Activities**

Street Sweeping and Cleaning

Street Repair and Maintenance

Bridge and Structure Maintenance

Sidewalk Surface Cleaning

Graffiti Cleaning

Sidewalk Repair

Controlling Litter

Fountain Maintenance

Landscape Mowing/Trimming/Planting

Fertilizer & Pesticide Management

Controlling Illicit Connections

Controlling Illegal Dumping

Solid Waste Collection and Recycling

**Table 1-1 Pollutant Impacts on Water Quality**

<b>Sediment</b>	Sediment is a common component of stormwater, and can be a pollutant. Sediment can be detrimental to aquatic life (primary producers, benthic invertebrates, and fish) by interfering with photosynthesis, respiration, growth, reproduction, and oxygen exchange in water bodies. Sediment can transport other pollutants that are attached to it including nutrients, trace metals, and hydrocarbons. Sediment is the primary component of total suspended solids (TSS), a common water quality analytical parameter.
<b>Nutrients</b>	Nutrients including nitrogen and phosphorous are the major plant nutrients used for fertilizing landscapes, and are often found in stormwater. 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. For example, nutrients have led to a loss of water clarity in Lake Tahoe. In addition, un-ionized ammonia (one of the nitrogen forms) can be toxic to fish.
<b>Bacteria and viruses</b>	Bacteria and viruses are common contaminants of stormwater. For separate storm drain systems, sources of these contaminants include animal excrement and sanitary sewer overflow. High levels of indicator bacteria in stormwater have led to the closure of beaches, lakes, and rivers to contact recreation such as swimming.
<b>Oil and Grease</b>	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.
<b>Metals</b>	Metals including lead, zinc, cadmium, copper, chromium, and nickel are commonly found in stormwater. Many of the artificial surfaces of the urban environment (e.g., galvanized metal, paint, automobiles, or preserved wood) contain metals, which enter stormwater as the surfaces corrode, flake, dissolve, decay, or leach. Over half the trace metal load carried in stormwater is associated with sediments. Metals are of concern because they are toxic to aquatic organisms, can bioaccumulate (accumulate to toxic levels in aquatic animals such as fish), and have the potential to contaminate drinking water supplies.
<b>Organics</b>	Organics may be found in stormwater in low concentrations. Often synthetic organic compounds (adhesives, cleaners, sealants, solvents, etc.) are widely applied and may be improperly stored and disposed. In addition, deliberate dumping of these chemicals into storm drains and inlets causes environmental harm to waterways.
<b>Pesticides</b>	Pesticides (including herbicides, fungicides, rodenticides, and insecticides) have been repeatedly detected in stormwater at toxic levels, even when pesticides have been applied in accordance with label instructions. As pesticide use has increased, so too have concerns about adverse effects of pesticides on the environment and human health. Accumulation of these compounds in simple aquatic organisms, such as plankton, provides an avenue for biomagnification through the food web, potentially resulting in elevated levels of toxins in organisms that feed on them, such as fish and birds.
<b>Gross Pollutants</b>	Gross Pollutants (trash, debris, and floatables) may include heavy metals, pesticides, and bacteria in stormwater. Typically resulting from an urban environment, industrial sites and construction sites, trash and floatables may create an aesthetic "eye sore" in waterways. Gross pollutants also include plant debris (such as leaves and lawn-clippings from landscape maintenance), animal excrement, street litter, and other organic matter. Such substances may harbor bacteria, viruses, vectors, and depress the dissolved oxygen levels in streams, lakes, and estuaries sometimes causing fish kills.
<b>Vector Production</b>	Vector production (e.g., mosquitoes, flies, and rodents) is frequently associated with sheltered habitats and standing water. Unless designed and maintained properly, standing water may occur in treatment control BMPs for 72 hours or more, thus providing a source for vector habitat and reproduction (Metzger, 2002).



## 1.3 Regulatory Requirements

The federal Clean Water Act (CWA), as amended in 1987, is the principal legislation for establishing requirements for the control of stormwater pollutants. Enforcement of the CWA and other laws such as the Endangered Species Act and California's Porter-Cologne Act has generated a number of federal, state and local requirements and programs that deal directly or indirectly with controlling stormwater discharges. In the following sections, various programs are discussed in relationship to control of pollutants in stormwater from municipal storm drain systems. These programs are expected to evolve over the next several years and the user is advised to contact local regulatory and/or municipal officials for further information.

### 1.3.1 Federal NPDES Programs

In 1972, provisions of the federal Water Pollution Control Act, also referred to as the Clean Water Act (CWA), were amended so that discharge of pollutants to waters of the United States from any point source is effectively prohibited, unless the discharge is in compliance with a National Pollutant Discharge Elimination (NPDES) permit. The 1987 amendments to the CWA added Section 402(p), which established a framework for regulating municipal, industrial, and construction stormwater discharges under the NPDES program. On November 16, 1990, USEPA published final Phase I regulations that established application requirements for stormwater permits for municipal separate storm sewer systems (MS4s) serving a population of over 100,000 and certain industrial facilities, including construction sites greater than 5 acres. These regulations were revised in July 1998 (USEPA, 1998). On December 8, 1999, USEPA published the final Phase II regulations for communities under 100,000 and operators of construction sites between 1 and 5 acres (USEPA, 1999).

### 1.3.2 State NPDES Programs

The state Porter-Cologne Act (Water Code 13000, et seq.) is the principal legislation for controlling stormwater pollutants in California. The Act requires development of Basin Plans for drainage basins within California. Each plan serves as a blueprint for protecting water quality within the various watersheds. These basin plans are used in turn to identify more specific controls for discharges (e.g., wastewater treatment plant effluent, urban runoff, and agriculture drainage). Specific controls are implemented through permits called Waste Discharge Requirements.

In California, the federal NPDES stormwater permitting program is administered by the State Water Resources Control Board (SWRCB) through the nine Regional Water Quality Control Boards (RWQCBs) by issuing joint Waste Discharge Requirements and NPDES permits. SWRCB and RWQCBs use three types of NPDES permits to regulate stormwater discharges. These include:

- Individual Permits
- Area Wide Permits
- General Permits

The current set of stormwater NPDES permits in California includes a combination of stormwater discharge type and permit type (Table 1-2). The following sections describe minimum requirements in each of the municipal discharge-permit combinations.

<b>Table 1-2 Stormwater Discharge-Permit Type Combinations</b>			
<b>Permit type</b>	<b>Discharge Type</b>		
	<b>Municipal</b>	<b>Construction</b>	<b>Industrial</b>
Individual	Phase I MS4 Caltrans		Facility-specific
Area Wide	Phase I MS4s		
General	Phase II MS4	Phase I and II	Phase I

### 1.3.3 Municipal NPDES Stormwater Programs

Municipalities with a population of over 100,000 or that have been determined to be a significant contributor of pollutants are required to obtain an individual NPDES stormwater permit. These municipalities are classified as Phase I communities and are typically referred to as MS4s (municipal separate storm sewer systems). To meet CWA Section 402(p) requirements, Phase I MS4s are required to implement a stormwater management program that contains the following elements:

- **Program Management**: including program structure, institutional arrangements, legal authority, and fiscal resources
- **Illicit Discharges**: including prohibition of illicit connections and dumping, and enforcement procedures.
- **Industrial / Commercial Discharges**: including identification of sources, BMPs, outreach, inspections, staff training, and coordination with state General Permit.
- **New Development and Re-development**: including planning processes, local permits, staff training, post-construction structural BMPs, and outreach.
- **Construction**: including erosion and grading permits, construction BMPs, site inspections, enforcement, and coordination with state General Permit.
- **Public Agency (Municipal) Operations**: including inventory and BMPs for corporation yards, parks and recreation, storm drain system operation and maintenance, streets and roads, flood control, public facilities, and ponds, fountains and other public water bodies. (This is a primary focus of this handbook.)
- **Public Information and Participation**: including general and focused outreach, school education programs, citizen participation, and effectiveness evaluation of the public information program.



- **Program Evaluation**: including performance standards, annual and sub-annual reports, internal reporting and record keeping, and Stormwater Management Plan revisions.
- **Monitoring**: including system characterization, source identification, control measure effectiveness, pollutant loading, and data management

Smaller, Phase II communities (under 100,000 population) are covered by a General Permit. Phase II communities are required to develop and implement a stormwater management plan with the following six minimum control measures:

- **Public Education and Outreach** - Distributing educational materials and performing outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality.
- **Public Involvement and Participation** - Providing opportunities for citizens to participate in program development, implementation, and review, including effectively publicizing public hearings or participation.
- **Illicit Discharge Detection and Elimination** - Developing and implementing a plan to detect and eliminate illicit discharges to the storm drain system including illicit connections and illegal dumping.
- **Construction Site Runoff Control** - Developing, implementing, and enforcing an erosion and sediment control program for construction activities that disturb one or more acres of land.
- **Pollution Prevention / Good Housekeeping for Municipal Operations** - Developing and implementing a program to prevent or reduce pollutant runoff from municipal operations. (This is a primary focus of this handbook.)
- **Post-Construction Stormwater Management in New Development and Redevelopment** - Developing, implementing, and enforcing a program to address discharges of stormwater runoff from new and redevelopment areas.

In addition to the six measures listed above, the stormwater management plan must identify measurable goals (or performance standards) for each minimum control measure. Measurable goals will be used by the MS4 and the RWQCB to gauge compliance and evaluate the effectiveness of individual BMPs or control measures and the stormwater management program as a whole. Phase II communities must also monitor their efforts and prepare annual reports demonstrating that the community has implemented the minimum control measures and complied with the measurable goals.

## 1.4 Definitions

Many of the common definitions for stormwater control are found in the Glossary (see Section 6). Throughout the handbook, the user will find references to the following terms:

**NPDES Permit for Stormwater Discharges** 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 Clean Water Act (CWA). In California, the State Water Resources Control Board (SWRCB) has issued a General Permit for stormwater discharges associated with Phase II communities. For Phase I communities the Regional Water Quality Control Boards issue individual NPDES permits to either an individual permittee or a group of permittees.

**Notice of Intent (NOI)** is a formal notice to the SWRCB submitted by a Phase II municipality. The NOI provides information on the permittee, location of discharge, type of discharge and certifies that the permittee will comply with conditions of the Phase II General Permit. The NOI is not a permit application and does not require approval.

A **Best Management Practice (BMP)** is defined as any program, technology, process, siting criteria, operating method, measure, or device which controls, prevents, removes, or reduces pollution.

**Source Control BMPs** are operational practices that prevent pollution by reducing potential pollutants at the source. They typically do not require maintenance or construction.

**Treatment Control BMPs** are methods of treatment to remove pollutants from stormwater.

**Non-Stormwater Discharge** is any discharge to municipal separate storm sewer that is not composed entirely of stormwater.

**Vector** as defined in the California Health & Safety Code, Section 2200, is any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rodents.

## 1.5 References and Resources

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<http://cfpub.epa.gov/npdes/stormwater/measurablegoals/part4.cfm#sub7>

United States Environmental Protection Agency (U.S.E.P.A.). *NPDES Stormwater Sampling Guidance Document*. 1992, EPA 833-B-92-001, U.S. Environmental Protection Office, Office of Wastewater Enforcement and Compliance, Washington, DC.

<http://www.swrcb.ca.gov/stormwtr/municipal.html#phaseii>. This link on the State Water Resources Control Board website provides Phase I MS4 area wide permits in each region, a link to Phase I and II resources.

<http://cfpub.epa.gov/npdes/stormwater/swphase1.cfm>. This link on the USEPA website provides an overview of the Phase I NPDES stormwater program and specific information on requirements pertaining to Phase I stormwater discharges.

## Municipal Programs

City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. Model Urban Runoff Program, A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. July 1998 (Revised February 2002).

City of Watsonville, City of Monterey, Monterey Bay National Marine Sanctuary, California Coastal Commission, and Central Coast Regional Water Quality Control Board, 2000. Model Urban Runoff Program, Supplementary 2000 Workbook: A Resource for Implementing Your Municipal Urban Runoff Program.

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities  
[http://ladpw.org/wmd/npdes/model\\_links.cfm](http://ladpw.org/wmd/npdes/model_links.cfm)

Orange County Stormwater Program.  
[http://www.ocwatersheds.com/StormWater/swp\\_documents\\_intro.asp](http://www.ocwatersheds.com/StormWater/swp_documents_intro.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Plan. 2001. Municipal Activities Model Program Guidance. November 2001.

*Section 1*  
*Introduction*

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

# Section 2

## Stormwater Pollution Prevention Planning for Municipal Operations

### 2.1 Introduction

As noted in Section 1 municipalities are required to develop and implement a comprehensive stormwater management program including the reduction of pollutants from municipal operations. In this section, a planning process is suggested for municipal operations, which allows the municipality to identify the activities that generate pollutants and the best management practices (BMPs) applicable to the activities. The recommended process includes the following key components:

- **Inventory:** First, an inventory is developed of all municipal facilities and activities that may be a source of pollutants in stormwater (Section 2.2).
- **Assessment:** Next, the activities are evaluated for their potential to discharge pollutants to storm drains and/or to receiving waters (Section 2.3).
- **BMP Selection:** BMPs are then selected to deal with the identified sources of stormwater pollution. Emphasis is placed on source control (procedures) BMPs and proper maintenance of treatment control BMPs (Section 2.4 and Sections 3 and 4).
- **Implementation:** BMPs are implemented and their effectiveness evaluated. The monitoring, reporting, and inspection requirements of the BMPs is oriented toward gaining insight into the performance of the BMPs (Section 5).

It is worth noting that some municipal facilities may be classified as an industrial-type facility subject to the State NPDES General Permit for Industrial Activities. The reader is referred to the Industrial and Commercial BMP Handbook to determine the classification of the municipal facility. If classified as an industrial facility then the reader should use the Industrial and Commercial BMP Handbook. For all other municipal facilities, the planning procedure described here is applicable.

### 2.2 Develop Inventory of Public Agency Activities

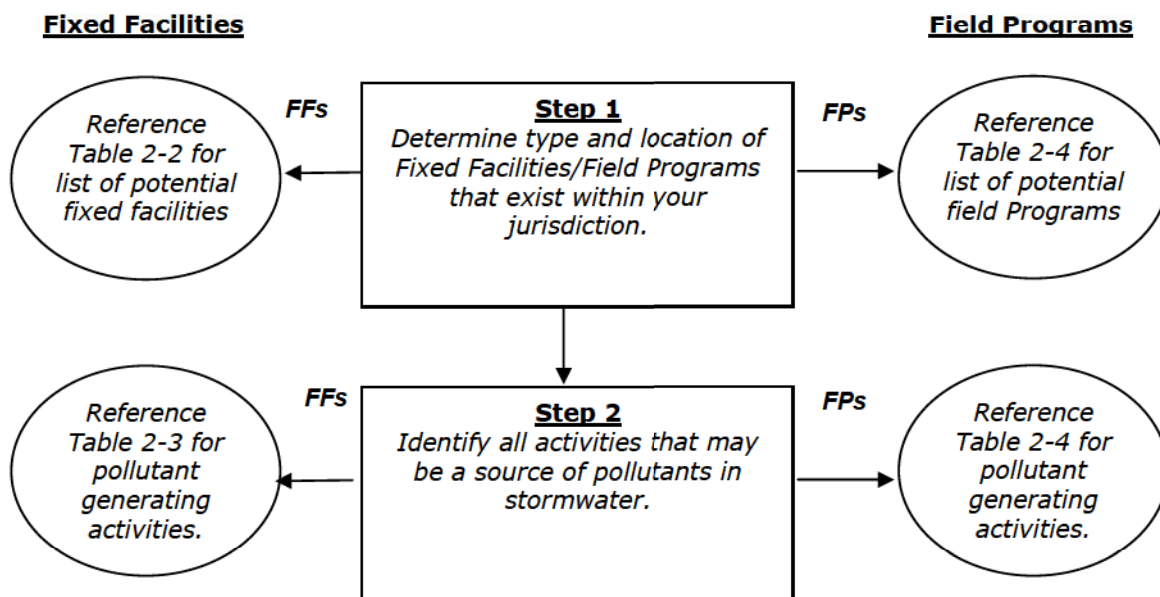
This section describes steps that may be used to generate and maintain comprehensive inventories of the pollutant generating activities associated with municipal operations. These activities can be categorized into two groups as described below:

- **Fixed Facilities** – specific locations municipalities own and operate and at which municipal activities occur. These types of facilities may also be municipally owned but privately leased. Examples of fixed facility types include municipal waste facilities and corporation yards.
- **Field Programs** - a set of related municipal activities that take place throughout the municipality. These types of activities may also be privately contracted. Examples of



municipal field programs include roads, streets, and highways maintenance, and drainage system operation and maintenance.

The flow chart presented in Figure 2-1 illustrates the two steps involved in compiling the inventories for both fixed facilities and field programs. A summary of the information that is collected as part of inventory is provided in Table 2-1. Sections 2.2.1 and 2.2.2 provide the guidelines for fully completing the inventories.



**Figure 2-1**  
**Inventory Process for Fixed Facilities and Field Programs**

**Table 2-1    Inventory Information**

<p style="text-align: center;"><b>Fixed Facility</b> <i>Facility Type and Location (Step 1)</i></p> <ul style="list-style-type: none"> <li>■ <i>Facility name/type of facility</i></li> <li>■ <i>Sub-category facility type (see Table 2-2)</i></li> <li>■ <i>Physical Address Information</i></li> <li>■ <i>Watershed and nearby water bodies</i></li> <li>■ <i>GIS Information (longitude and latitude, etc.)</i></li> <li>■ <i>Site Map</i></li> </ul> <p style="text-align: center;"><i>Facilities Activities and Pollutants (Step 2)</i></p> <ul style="list-style-type: none"> <li>■ <i>Facility Activities</i></li> <li>■ <i>Potential Pollutants (See Table 2-3)</i></li> <li>■ <i>Pollutants of concern into a 303(d) listed water body or other ESA</i></li> <li>■ <i>List of past significant spills and leaks</i></li> <li>■ <i>List of significant materials and chemicals</i></li> <li>■ <i>Potential non-stormwater discharges</i></li> </ul> <p style="text-align: center;"><b>Field Program</b> <i>Program Type and Location (Step 1)</i></p> <ul style="list-style-type: none"> <li>■ <i>Program type</i></li> <li>■ <i>Name and contact information of contractor (if work is contracted out)</i></li> <li>■ <i>Area of coverage</i></li> <li>■ <i>Watershed(s) within coverage area (hydrologic units)</i></li> <li>■ <i>Description of drainage facilities (number, size, length of open channels and closed conduits)</i></li> <li>■ <i>Adjacent to and/or discharge to 303(d) listed water body or other ESA</i></li> </ul> <p style="text-align: center;"><i>Program Activities and Pollutants (Step 2)</i></p> <ul style="list-style-type: none"> <li>■ <i>Activities performed (see Table 2-4)</i></li> <li>■ <i>Potential Pollutants (See Table 2-4)</i></li> <li>■ <i>Pollutants of concern into a 303(d) listed water body or other ESA</i></li> <li>■ <i>Potential non-stormwater discharges</i></li> </ul>
---

## 2.2.1 Fixed Facility Inventory Procedures

### Step 1 – Determine Fixed Facilities Type and Location

The first step in the inventory process is to identify fixed facilities that are owned and operated or owned and leased by the city (county). Baseline information about the fixed facility needs to be developed including the name, address, type of facility, longitude and latitude, and watershed.

Each fixed facility should be identified with a main and subcategory type within the inventory. The main and subcategory types that typically have the greatest potential for discharging pollutants are listed in Table 2-2.

A site map should be prepared for each fixed facility that includes:

- The facility boundaries
- The outline of all stormwater drainage areas
- Portions of the drainage area impacted by run-on from surrounding areas
- Direction of flow of each drainage area
- On-site surface water bodies
- Areas of soil erosion
- Nearby water bodies (such as rivers, lakes, ponds)
- Municipal storm drain inlets where the facility's stormwater discharges
- Stormwater collection and conveyance system, associated points of discharge, and the flow direction

<b>Table 2-2 Types of Municipal Fixed Facilities</b>	
<b>Main Fixed Facility Types</b>	<b>Subcategory of Fixed Facilities</b>
<b>Municipal Waste Facilities</b>	Active or Closed Municipal Landfills
	Publicly Owned Treatment Facilities
	Incinerators
	Solid Waste Transfer Facilities
	Land Application Sites
	Sites for Disposing and Treating Sewage Sludge
	Hazardous Waste Treatment, Disposal, and Recovery Facilities
	Uncontrolled Sanitary Landfills
<b>Corporation Yards</b>	Corporation Yards
	Maintenance Yards
	Storage Yards for Materials
<b>Other Municipal Owned and/or Operated Facilities</b>	Airfields
	Parks, Cemeteries & Golf Courses
	Public Buildings (Police, Fire, Libraries, etc.)
	Stadiums
	Stables
	Boat/Shipping Yards
	Animal Shelters/Services
	Public Parking Facilities
	Fairgrounds
	Other Facilities Identified by the Municipality

- Control measures that affect stormwater discharges
- Locations of all catch basins
- Location of authorized non-stormwater discharges to the storm drain
- Outline of all impervious areas of the facility
- Locations where materials are directly exposed to precipitation
- Locations where significant spills or leaks have occurred
- Areas of municipal activities

The inventory should also determine whether the facility is within or adjacent to or discharging directly to an Environmentally Sensitive Area (ESA). For the purposes of this Handbook, “adjacent” is defined as being located within 200 feet of the listed water body. “Discharging directly to” is defined as a discharge from a drainage system servicing the subject facility or activity that flows to the ESA without mixing with other flows (i.e., discharge from an urban area that co-mingles with downstream flows prior to an ESA is not subject to this definition).

An ESA exists if any of the following designations have been applied to the water body of concern:

- Clean Water Act 303(d) listed impaired water body. It should be noted that the 303(d) list is updated on a regular basis by the state and USEPA. Each time that happens, maps showing 303(d) listed water bodies and the inventories will need to be updated.
- Areas designated as Areas of Special Biological Significance (also known as State Water Quality Protection Area) by the SWRCB
- Water bodies designated with the RARE beneficial use by the SWRCB
- Water bodies located within areas designated as preserves or equivalent under the Natural Community Conservation Planning Program
- Areas designated as Critical Aquatic Resources
- Any other equivalent ESAs that contain water bodies which have been identified to be of local concern

An example of an inventory of municipal operations is provided in Appendix A.



## Step 2 – Identify Potential Pollutant Generating Activities

In addition to the identification of the main and subcategories of fixed facility types in Step 1, the potential pollutant generating activities and potential pollutants for each fixed facility should be identified and included in the inventory.

A list of fixed facility activities that have the potential to generate pollutant discharges and the potential pollutants that are associated with those activities is presented in Table 2-3. This list is not inclusive but does provide a good starting point to identify potential pollutants. In addition to these activities, efforts should be made to compile a list of past significant spills and leaks and a list of materials and chemicals stored on-site.

Finally, determine if pollutants associated with identified activities have the potential to discharge into 303 (d) listed water bodies for which the pollutant is listed.

<b>Table 2-3 Potential Pollutants Likely Associated with Fixed Facility Activities</b>									
<b>Fixed Facility Activity</b>	<b>Potential Pollutants</b>								
	<b>Sediment</b>	<b>Nutrients</b>	<b>Trash</b>	<b>Metals</b>	<b>Bacteria</b>	<b>Oil &amp; Grease</b>	<b>Organics</b>	<b>Pesticides</b>	<b>Oxygen Demanding Substances</b>
Building and Grounds Maintenance and Repair	X	X	X	X	X	X	X	X	X
Parking/Storage Area Maintenance	X	X	X	X	X	X	X		X
Waste Handling and Disposal	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Fueling			X	X		X	X		
Vehicle and Equipment Maintenance and Repair				X		X	X		
Vehicle and Equipment Washing and Steam Cleaning	X	X	X	X		X	X		
Outdoor Loading and Unloading of Materials	X	X	X	X		X	X	X	X
Outdoor Container Storage of Liquids		X		X		X	X	X	X
Outdoor Storage of Raw Materials	X	X	X			X	X	X	X
Outdoor Process Equipment	X		X	X		X	X		
Over water Activities			X	X	X	X	X	X	X
Landscape Maintenance	X	X	X		X			X	X



## **2.2.2 Field Program Inventory Procedures**

### **Step 1 – Determine Field Program Type and Location**

The first step in the inventory process is to identify all field programs conducted by a municipality. The field program and associated activities that have the potential for pollutant discharges are listed in Table 2-4. This list is not inclusive but serves as a starting point for identifying applicable field programs. Baseline information about field programs should be included in the inventory, such as the approximate area of coverage for the field program and an identifier if the performance of the field program is contracted out.

In addition, the watershed where the program occurs should be identified. Most field programs are conducted throughout a political jurisdiction and therefore may affect multiple watersheds. The inventory should reflect all those watersheds in which field programs occur. Mapping the field program infrastructure according to watershed may be useful in this step. As with the fixed facilities inventory information regarding environmentally sensitive areas including location and stressor pollutant should be compiled as part of the inventory effort. See Table 2-1 for a more complete list of information that may be collected during the inventory procedure.

### **Step 2 – Identify Potential Pollutant Generating Activities**

The potential pollutant generating activities and potential pollutants for each field program must be identified and included in the inventory. A list of field program activities that have the potential to generate pollutant discharges and the potential pollutants that are associated with those activities is presented in Table 2-4.

Although Table 2-4 identifies the primary pollutants typically associated with stormwater runoff there are other environmental conditions that may be applicable to a field program. These include pH, temperature, and toxicity.

**Table 2-4 Field Program Activities and Associated Potential Pollutants**

Field Programs	Activities	Potential Pollutants								
		Sediment	Nutrients	Trash	Metals	Bacteria	Oil & Grease	Organics	Pesticides	Oxygen Demanding Substances
Roads, Streets, and Highways Operation and Maintenance	Sweeping and Cleaning	X		X	X		X			X
	Street Repair, Maintenance, and Striping /Painting	X		X	X		X	X		
	Bridge and Structure Maintenance	X		X	X		X	X		
Plaza, Sidewalk, and Parking Lot Maintenance and Cleaning	Surface Cleaning	X	X			X	X			X
	Graffiti Cleaning	X	X		X			X		
	Sidewalk Repair	X		X						
	Controlling Litter	X		X		X	X			X
Fountains, Pools, Lakes, and Lagoons Maintenance	Fountain and Pool Draining		X					X		
	Lake and Lagoon Maintenance	X	X	X		X			X	X
Landscape Maintenance	Mowing/Trimming/Planting	X	X	X		X			X	X
	Fertilizer & Pesticide Management	X	X						X	
	Managing Landscape Wastes			X					X	X
	Erosion Control	X	X							
Drainage System Operation and Maintenance	Inspection and Cleaning of Stormwater Conveyance Structures	X	X	X		X		X		X
	Controlling Illicit Connections and Discharges	X	X	X	X	X	X	X	X	X
	Controlling Illegal Dumping	X	X	X	X	X	X	X	X	X
	Maintenance of Inlet and Outlet Structures	X		X	X		X			X
Waste Handling and Disposal	Solid Waste Collection		X	X	X	X	X	X		X
	Waste Reduction and Recycling			X	X					X
	Household Hazardous Waste Collection			X	X		X	X	X	
	Controlling Litter			X	X	X		X		X
	Controlling Illegal Dumping	X		X		X	X		X	X
Water and Sewer Utility Operation and Maintenance	Water line Maintenance	X				X	X			
	Sanitary Sewer Maintenance	X				X	X			X
	Spill/Leak/Overflow Control, Response, and Containment	X	X			X		X		X

## **2.3 Assessment**

This section outlines the procedures for assessing fixed facilities and field programs for BMP selection and implementation. Data gathered during the inventory process should be used to support the assessment process described below.

### **2.3.1 Assessment of Fixed Facilities**

The first step in the assessment is to identify BMPs already in place at a facility. These may include pavement sweeping, drain inlet cleaning, covered waste storage bins, and spill prevention and cleanup procedures. This information should be considered when determining which BMPs should be selected and implemented at a site. Worksheet 1 provides a checklist that may be helpful in determining existing BMPs at a site. Other BMPs that were installed for reasons unrelated to stormwater control, such as berming, covered materials storage, and designated wash areas, should also be identified.

Once the existing BMPs have been identified and the inventory completed per Section 2.2, an assessment of all municipal activities and potential pollutant sources should be conducted to determine which areas of the facility are likely sources of pollutants in stormwater and non-stormwater discharges, and which pollutants are likely to be present in stormwater and non-stormwater discharges. Worksheet 1 may help with this task.

Facility operators must then decide whether additional or new BMPs should be implemented to reduce stormwater pollutants to the maximum extent practicable from a site. The municipality should consider and evaluate various factors when performing this assessment, such as:

- effectiveness of current BMPs
- type of activities
- type and quantities of significant materials handled, produced, stored, or disposed of
- history of spill or leaks
- non-stormwater discharges
- size of facility (including percent impervious)
- proximity to receiving water and/or type of receiving water

The municipality should also consider whether its facility is discharging pollutants identified to be causing impairment in the local water bodies. Appendix B provides an example of a method for assessing a facility for BMP implementation.

### **2.3.2 Assessment of Field Programs**

Similar to the effort at a fixed facility a municipality should identify BMPs that are already in place and the extent of their effectiveness. Using this information and the inventory data the municipality can identify the activities with the potential for discharging pollutants, the type of



pollutants being discharged, and the extent that the pollutants are being addressed with current procedures or BMPs. The municipality can then assess whether additional or new BMPs are necessary. In considering the need for new or additional BMPs, a municipality should consider:

- effectiveness of current BMPs
- type of field program and pollutants being discharged
- exposure of activities to stormwater
- land use category
- proximity to receiving water and/or type of receiving water

## 2.4 Identify and Select BMPs

Selection of BMPs should focus first on source control BMPs and second on treatment control BMPs. Typically, source control BMPs will serve to reduce pollutants from activities to the maximum extent practicable. Treatment controls BMPs should be considered when source control BMPs have been shown to be ineffective or when special environmental or site conditions warrant a more comprehensive approach. The reader is referred to the New Development and Redevelopment BMP Handbook if treatment control BMPs are determined to be necessary. An example of selecting source control BMPs is provided in Appendix C.

Municipalities can identify and select BMPs from those presented in Section 3 – Source Control BMPs. The BMPs are described in activity-based and field program-based fact sheets that also provide information on the pollutants that can be addressed by the BMP. The BMPs shown in Section 3 are a comprehensive collection and not all may be applicable to the activities or field programs of a particular municipality. In order to be effective, BMPs must be appropriate to the application and properly implemented.

Municipalities must also consider the maintenance requirements of existing treatment control BMPs. In this regard, the municipality should refer to Section 4 –Treatment Control BMPs. The fact sheets in Section 4 are focused on the maintenance requirements of these treatment control BMPs. Proper maintenance is necessary for these controls to operate effectively.

## WORKSHEET 1

Facility Name:

Site Address:

Contact Name:

Phone:

1. **ACTIVITIES** – In the table below check each activity present at the site and evaluate its **potential for pollutant discharge (PPD)**: 1 = high potential, 2= medium potential, 3= low potential
2. **BMP EFFECTIVENESS** – In the table below, provide an effectiveness rating using the provided scale.

ACTIVITY AND BMP CHECKLIST				
	APPLICABLE ACTIVITY			EFFECTIVENESS RATING *
	Yes	No	PPD	
A. VEHICLE AND EQUIPMENT FUELING BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
B. VEHICLE AND EQUIPMENT WASHING/STEAM CLEANING BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
C. VEHICLE AND EQUIPMENT MAINTENANCE AND REPAIR BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
D. OUTDOOR LOADING/UNLOADING OF MATERIALS BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
E. OUTDOOR CONTAINER STORAGE OF LIQUIDS BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
F. OUTDOOR PROCESS EQUIPMENT OPERATIONS AND MAINTENANCE BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
G. OUTDOOR STORAGE OF RAW MATERIALS BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
H. WASTE HANDLING AND DISPOSAL BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
I. BUILDING AND GROUNDS MAINTENANCE BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
J. PARKING/STORAGE AREA MAINTENANCE BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
K. OVER WATER ACTIVITIES BMPs employed:	[ ]	[ ]	[ ]	① ② ③ ④ ⑤
L. OTHER (describe):	[ ]	[ ]	[ ]	① ② ③ ④ ⑤

- \*① No BMPs used and stormwater pollution likely    ② Some BMPs used but not effective    ③ Some BMPs used and moderately effective  
 ④ Source control BMPs used and very effective/structural BMPs needed    ⑤ All necessary BMPs used and very effective

### 3. TYPE AND QUANTITY OF MATERIALS USED

Material	Typical Quantity/Frequency	Is Stored Material Likely to Generate Pollutants
----------	----------------------------	--

### 4. HISTORY OF SPILLS AND LEAKS

- a) Is there a chronic history of spills and leaks? \_\_\_\_\_



## Section 2

### Stormwater Pollution Prevention Planning for Municipal Operations

- b) Is there no evidence of leaks and drips from equipment and machinery? \_\_\_\_\_
- c) Is there a spill prevention and response team? \_\_\_\_\_
- d) Are appropriate spill containment and cleanup materials kept on-site and in convenient locations? \_\_\_\_\_
- e) Are cleanup procedures for spills followed regularly and correctly? \_\_\_\_\_
- f) Are used absorbent materials removed and disposed of in a timely manner? \_\_\_\_\_
- g) Are personnel regularly trained in the use of spill control materials? \_\_\_\_\_

#### 5. NON-STORMWATER DISCHARGES

- a) Outfall directly observed during assessment \_\_\_\_\_
- b) Are BMPs implemented to prevent, treat, or control non-stormwater discharges? \_\_\_\_\_
- c) Is there a potential for non-stormwater discharges (i.e. non-stormwater sources observed without BMPs implemented) \_\_\_\_\_

#### 6. SIZE OF FACILITY (incorporating the size of a facility serves as a surrogate measure for flow)

- a) Total area \_\_\_\_\_
- b) The impervious area (including parking lot) is \_\_\_\_\_

#### 7. PROXIMITY TO RECEIVING WATER

Does the facility discharge directly or adjacent to a 303(d) water body or other environmentally sensitive area? \_\_\_\_\_

# Section 3

## Source Control BMPs

### 3.1 Introduction

This section provides a description of specific source control Best Management Practices (BMPs) for activities related to municipal operations. As noted in Sections 1 and 2, municipal fixed facilities conduct activities that have the potential to generate pollutants. The source control BMPs in this section address these activities (see Table 3-1).

In addition, municipalities conduct various field programs where activities may occur and create pollutants. BMPs for these field programs and associated activities are listed in Table 3-2.

**Table 3-1 Municipal Fixed Facility BMPs**

<b>Non-Stormwater Management</b>	
SC-10	Non-Stormwater Discharges
SC-11	Spill Prevention, Control and Cleanup
<b>Vehicle and Equipment Management</b>	
SC-20	Vehicle and Equipment Fueling
SC-21	Vehicle and Equipment Cleaning
SC-22	Vehicle and Equipment Repair
<b>Material and Waste Management</b>	
SC-30	Outdoor Loading/Unloading
SC-31	Outdoor Container Storage
SC-32	Outdoor Equipment Maintenance
SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
<b>Building and Grounds Management</b>	
SC-41	Building and Grounds Maintenance
SC-43	Parking/Storage Area Maintenance
<b>Over Water Activities</b>	
SC-50	Over Water Activities
<b>General Stormwater Management</b>	
SC-60	Housekeeping Practices
SC-61	Safer Alternative Products

**Table 3-2 Municipal Field Program BMPs**

SC-70	Road and Street Maintenance
SC-71	Plaza and Sidewalk Cleaning
SC-72	Fountains & Pools Maintenance
SC-73	Landscape Maintenance
SC-74	Drainage System Maintenance
SC-75	Waste Handling and Disposal
SC-76	Water and Sewer Utility Maintenance

## 3.2 Fact Sheet Format

Each BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the activities listed in Tables 3-1 and 3-2 are provided in Section 3.3.

The fact sheets also contain side bar presentations with information on BMP objectives and targeted constituents.

The information provided in each fact sheet is extensive and may not be applicable to all municipal operations. The readers may find it helpful to modify and simplify the BMP fact sheets to better reflect their existing operations.

## 3.3 BMP Fact Sheets

BMP fact sheets for fixed facilities activities and field programs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusions in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at <http://www.cabmphandbooks.com>

### SC-xx Example Fact Sheet

#### Description of the BMP

#### Approach

Pollution Prevention  
Suggested Protocols  
Training  
Spill Response and Prevention  
Other Considerations

#### Requirements

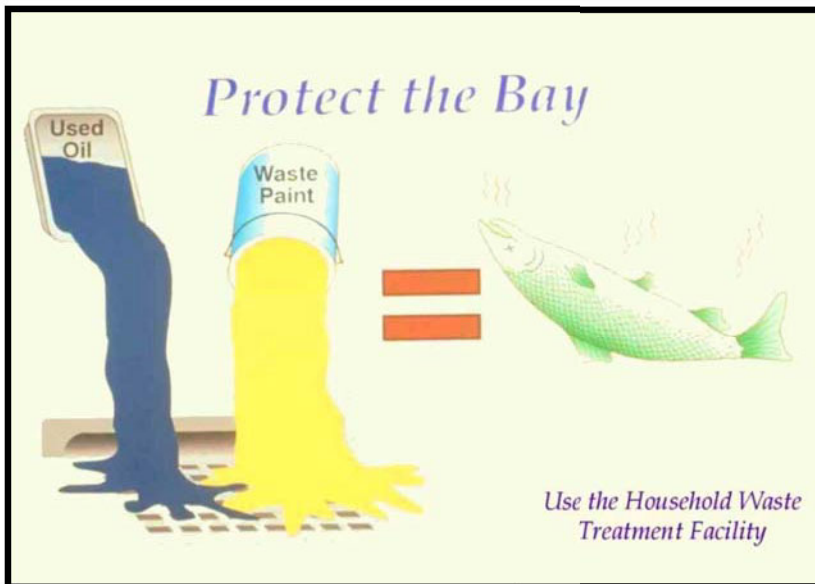
Costs  
Maintenance

#### Supplemental Information

Further Details on the BMP  
Examples

#### References and Resources

**Figure 3-1  
Example Fact Sheet**



Graphic by: Margie Winter

## Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

## Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs

## Objectives

- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>





the field staff must be trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

***Suggested Protocols*****Fixed Facility***General*

- Post “No Dumping” signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.

*Illicit Connections*

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of “as-built” piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

*Visual Inspection and Inventory*

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

*Review Infield Piping*

- Review the “as-built” piping schematic as a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

*Smoke Testing*

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.



- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

## *Dye Testing*

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

## *TV Inspection of Storm Sewer*

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

## *Illegal Dumping*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, 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 a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

## **Field Program**

### *General*

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.

*Field Inspection*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

*Recommended Complaint Investigation Equipment*

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms.
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms

- Educational materials

## *Reporting*

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any onsite drainage points observed.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

## *Enforcement*

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
  - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
  - Provide information regarding BMPs to the responsible party, where appropriate.
  - Begin enforcement procedures, if appropriate.
  - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

## *Training*

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.



- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

***Spill Response and Prevention***

- See SC-11 Spill Prevention Control and Clean Up

***Other Considerations***

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

**Requirements*****Costs***

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

***Maintenance***

Not applicable

## Supplemental Information

### *Further Detail of the BMP*

*What constitutes a “non-stormwater” discharge?*

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

### *Permit Requirements*

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.



Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

### *Illegal Dumping*

- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties

### *Outreach*

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There are a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

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- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

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  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

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of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

#### *Storm Drain Stenciling*

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

#### *Oil Recycling*

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

#### ***Household Hazardous Waste***

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

#### ***Training***

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

#### ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.



## ***Other Considerations***

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling element and a HHW element within their integrated waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

## ***Examples***

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel “Do Not Disturb” signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control’s Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

## **References and Resources**

<http://www.stormwatercenter.net/>

California’s Nonpoint Source Program Plan <http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program,  
[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program  
(<http://www.projectcleanwater.org>)

Santa Clara Valley Urban Runoff Pollution Prevention Program  
[http://www.scvurppp-w2k.com/pdf%20documents/PS\\_ICID.PDF](http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF)





# Spill Prevention, Control & Cleanup SC-11



## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

## Approach

- An effective spill response and control plan should include:
  - Spill/leak prevention measures;
  - Spill response procedures;
  - Spill cleanup procedures;
  - Reporting; and
  - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

## Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

## Targeted Constituents

Sediment	
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑



# **SC-11 Spill Prevention, Control & Cleanup**

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- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
  - Assessment of the site and potential impacts
  - Containment of the material
  - Notification of the proper personnel and evacuation procedures
  - Clean up of the site
  - Disposal of the waste material and
  - Proper record keeping
- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

## ***Suggested Protocols***

### ***Spill/Leak Prevention Measures***

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

# Spill Prevention, Control & Cleanup SC-11

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- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.
- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.
- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.
- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.
- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.
- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

## ***Training***

- Educate employees about spill prevention, spill response and cleanup on a routine basis.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.
- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.
- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

## ***Spill Response and Prevention***

- Identify key spill response personnel and train employees on who they are.
- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.
- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).



# **SC-11 Spill Prevention, Control & Cleanup**

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- Follow the Spill Prevention Control and Countermeasure Plan if one is available.
- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.
- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.
- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

## *Spill Cleanup Procedures*

- Small non-hazardous spills
  - Use a rag, damp cloth or absorbent materials for general clean up of liquids
  - Use brooms or shovels for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- Large non-hazardous spills
  - Use absorbent materials for general clean up of liquids
  - Use brooms, shovels or street sweepers for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.
- If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

## *Reporting*

- Report any spills immediately to the identified key municipal spill response personnel.

# Spill Prevention, Control & Cleanup SC-11

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- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)
- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)
- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

## ***Other Considerations***

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure Plan (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, if permitted to do so, prohibiting any hard connections to the storm drain.

## **Requirements**

### ***Costs***

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of wastes, contaminated soil and water is very expensive

### ***Maintenance***

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Reporting***

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and cleanup activities, and comply with legal requirements.

A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm drain.



# **SC-11 Spill Prevention, Control & Cleanup**

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These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

## ***Examples***

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

## **References and Resources**

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



## Description

Spills and leaks that occur during vehicle and equipment fueling can contribute hydrocarbons, oil and grease, as well as heavy metals to stormwater runoff. Implementing the following management practices can help prevent fuel spills and leaks.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

## Pollution Prevention

- Use properly maintained offsite fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Educate employees about pollution prevention measures and goals
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.

## Suggested Protocols

### General

- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	



- Label drains within the facility boundary, by paint/stencil (or equivalent), to indicate whether they flow to an oil/water separator, directly to the sewer, or to a storm drain. Labels are not necessary for plumbing fixtures directly connected to the sanitary sewer but may be useful to help eliminate confusion about where the drain leads.
- Post signs to remind employees not to top off the fuel tank when filling and signs that ban employees from changing engine oil or other fluids at that location.
- Report leaking vehicles to fleet maintenance.
- Install inlet catch basin equipped with a small sedimentation basin or grit chamber to remove large particles from stormwater in highly impervious areas. Proper maintenance of these devices is necessary.
- Accumulated non-contaminated stormwater (e.g., in a secondary containment) should be released prior to next storm.
- Ensure the following safeguards are in place:
  - Overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
  - Protective guards around tanks and piping to prevent vehicle or forklift damage.
  - Clearly tagging or labeling all valves to reduce human error.
  - Automatic shut off for severed fuel hoses.

#### *Fuel Dispensing Areas*

- Maintain clean fuel-dispensing areas using dry cleanup methods such as sweeping for removal of litter and debris, or use of rags and absorbents for leaks and spills. Do not wash down areas with water.
- Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
- Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- Design fueling area to prevent stormwater runoff and spills.
- Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area and if possible use a perimeter drain or slope pavement inward with drainage to a blind sump (must be properly maintained and water properly disposed of); pave area with concrete rather than asphalt.



- Apply a suitable sealant that protects the asphalt from spilled fuels in areas where covering is infeasible and the fuel island is surrounded by pavement.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Cover storm drains in the vicinity during transfer.

## *Outdoor Waste Receptacle Area*

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Minimize the possibility of stormwater pollution from outside waste receptacles by using an effective combination of the following:
  - use only watertight waste receptacle(s) and keep the lid(s) closed, or
  - grade and pave the waste receptacle area to prevent runoff of stormwater, or
  - install a roof over the waste receptacle area, or
  - install a low containment berm around the waste receptacle area, or
  - use and maintain drip pans under waste receptacles. Containment areas and drip pans must be properly maintained and collected water disposed of properly (e.g., to sanitary sewer). Several drip pans should be stored in a covered location near outdoor waste receptacle area so that they are always available, yet protected from precipitation when not in use.
- Post “no littering” signs.

## *Air/Water Supply Area*

- Minimize the possibility of stormwater pollution from air/water supply areas by implementing an effective combination of the following:
  - spot clean leaks and drips routinely to prevent runoff of spillage, or
  - grade and pave the air/water supply area to prevent runoff of stormwater, or
  - install a roof over the air/water supply area, or
  - install a low containment berm around the air/water supply area. Maintain containment areas and dispose of contaminated water properly (e.g., to sanitary sewer).

## *Inspection*

- Aboveground Tank Leak and Spill Control:
  - Check for external corrosion and structural failure.



# **SC-20      Vehicle and Equipment Fueling**

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- Check for spills and overfills due to operator error.
  - Check for failure of piping system.
  - Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
  - Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
  - Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
  - Periodically, integrity testing should be conducted by a qualified professional.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the facility boundary before October 1 each year.

## ***Training***

- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Train employees on proper fueling and cleanup procedures.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

## ***Spill Response and Prevention***

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place stockpiles of spill cleanup materials where they are readily accessible.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly and dispose properly.
- Store portable absorbent booms (long flexible shafts or barriers made of absorbent material) in unbermed fueling areas.
- Report spills promptly.
- Install an oil/water separator and connect to the sanitary sewer (if allowed), if a dead-end sump is not used to collect spills.

## ***Other Considerations***

- Carry out all federal and state requirements regarding underground storage tanks, or install above ground tanks.

## Requirements

### *Costs*

- The retrofitting of existing fueling areas to minimize stormwater exposure or spill runoff can be expensive. Good design must occur during the initial installation.
- Extruded curb along the “upstream” side of the fueling area to prevent stormwater runoff is of modest cost.

### *Maintenance*

- Clean oil/water separators at appropriate intervals.
- Keep ample supplies of spill cleanup materials onsite.
- Inspect fueling areas, storage tanks, catch basin inserts, containment areas, and drip pans on a regular schedule.

## Supplemental Information

### *Design Considerations*

#### *Designing New Installations*

The elements listed below should be included in the design and construction of new or substantially remodeled facilities.

#### Fuel Dispensing Areas

- Fuel dispensing areas must be paved with Portland cement concrete (or, equivalent smooth impervious surface), with a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents runoff of stormwater to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the “fuel dispensing area” stated above.
- The fuel dispensing area must be covered, and the cover’s minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area, as defined above. The cover must not drain onto the fuel dispensing area.
- If necessary install and maintain an oil control device in the appropriate catch basin(s) to treat runoff from the fueling area.

#### Outdoor Waste Receptacle Area

- Grade and pave the outdoor waste receptacle area to prevent runoff of stormwater to the extent practicable.

#### Air/Water Supply Area

- Grade and pave the air/water supply area to prevent runoff of stormwater to the extent practicable.

# SC-20      Vehicle and Equipment Fueling

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## *Designated Fueling Area*

- If your facility has large numbers of mobile equipment working throughout the site and you currently fuel them with a mobile fuel truck, consider establishing a designated fueling area. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary “caps” over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain.

## **Examples**

The Spill Prevention Control and Countermeasure (SPCC) Plan, which is required by law for some facilities, is an effective program to reduce the number of accidental spills and minimize contamination of stormwater runoff.

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program’s elements, including specific BMP guidance and lists of equipment suppliers, are also applicable to industrial facilities.

## **References and Resources**

Best Management Practice Guide for Retail Gasoline Outlets, California Stormwater Quality Task Force. 1997.

King County Stormwater Pollution Control Manual –  
<http://www.dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)



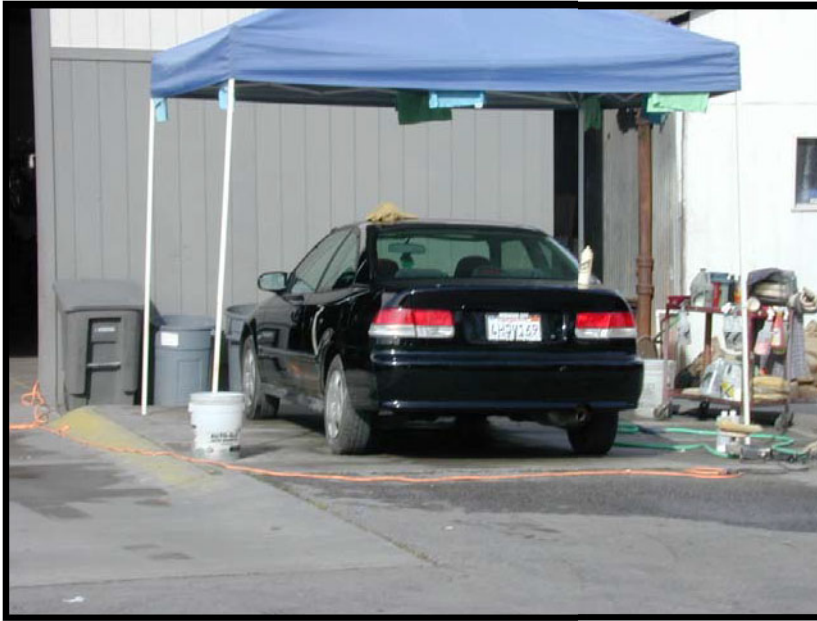


Photo Credit: Geoff Brosseau

## Description

Wash water from vehicle and equipment cleaning activities performed outdoors or in areas where wash water flows onto the ground can contribute toxic hydrocarbons and other organic compounds, oils and greases, nutrients, phosphates, heavy metals, and suspended solids to stormwater runoff. Use of the procedures outlined below can prevent or reduce the discharge of pollutants to stormwater during vehicle and equipment cleaning.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives

## Pollution Prevention

- If possible, use properly maintained off-site commercial washing and steam cleaning businesses whenever possible. These businesses are better equipped to handle and properly dispose of the wash waters.
- Good housekeeping practices can minimize the risk of contamination from wash water discharges.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	





# **SC-21      Vehicle and Equipment Cleaning**

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## ***Suggested Protocols***

### *General*

- Use biodegradable, phosphate-free detergents for washing vehicles as appropriate.
- Mark the area clearly as a wash area.
- Post signs stating that only washing is allowed in wash area and that discharges to the storm drain are prohibited.
- Provide a trash container in wash area.
- Map on-site storm drain locations to avoid discharges to the storm drain system.
- Emphasize the connection between the storm drain system and runoff and help reinforce that car washing activities can have an affect on local water quality. This can be accomplished through storm drain stenciling programs.

### *Vehicle and Equipment Cleaning*

- Design wash areas to properly collect and dispose of wash water when engine cleaning is conducted and when chemical additives, solvents, or degreasers are used. This may include installation of sumps or drain lines to collect wash water or construction of a berm around the designated area and grading of the area to collect wash water as well as prevent stormwater run-on.
- Consider washing vehicles and equipment inside the building if washing/cleaning must occur on-site. This will help to control the targeted constituents by directing them to the sanitary sewer.
- If washing must occur on-site and outdoor:
  - Use designated paved wash areas. Designated wash areas must be well marked with signs indicating where and how washing must be done. This area must be covered or bermed to collect the wash water and graded to direct the wash water to a treatment or disposal facility.
  - Oil changes and other engine maintenance cannot be conducted in the designated washing area. Perform these activities in a place designated for such activities.
  - Cover the wash area when not in use to prevent contact with rain water.
- Use hoses with nozzles that automatically turn off when left unattended.
- Perform pressure cleaning and steam cleaning off-site to avoid generating runoff with high pollutant concentrations. If done on-site, no pressure cleaning and steam cleaning should be done in areas designated as wellhead protection areas for public water supply.

### *Disposal*

- Consider filtering and recycling wash water.

- Discharge equipment wash water to the sanitary sewer, a holding tank, or a process treatment system, regardless of the washing method used.
- Discharge vehicle wash water to (1) the sanitary sewer, a holding tank, or process treatment system or (2) an enclosed recycling system.
- Discharge wash water to sanitary sewer only after contacting the local sewer authority to find out if pretreatment is required.

## ***Training***

- Train employees on proper cleaning and wash water disposal procedures and conduct “refresher” courses on a regular basis.
- Train staff on proper maintenance measures for the wash area.
- Train employees and contractors on proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control and Cleanup.
- Keep your Spill Prevention Control and Counter Measure (SPCC) Plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Clean up spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations (Limitations and Regulations)***

- Some municipalities may require pretreatment and monitoring of wash water discharges to the sanitary sewer.
- Steam cleaning can generate significant pollutant concentrations requiring that careful consideration be given to the environmental impacts and compliance issues related to steam cleaning.
- Most car washing best management practices are inexpensive, and rely more on good housekeeping practices (where vehicles are washed, planning for the collection of wash water) than on expensive technology. However, the construction of a specialized area for vehicle washing can be expensive for municipal facilities. Also, for facilities that cannot recycle their wash water the cost of pre-treating wash water through either structural practices or planning for collection and hauling of contaminated water to sewage treatment plants can represent a cost limitation.

## **Requirements**

### ***Costs***

- Capital costs vary depending on measures implemented

# **SC-21      Vehicle and Equipment Cleaning**

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- Low cost (\$500-1,000) for berm construction,
  - Medium cost (\$5,000-20,000) for plumbing modifications (including re-routing discharge to sanitary sewer and installing simple sump).
  - High cost (\$30,000-150,000) for on-site treatment and recycling.
- O&M costs increase with increasing capital investment.

## ***Maintenance***

- Berm repair and patching.
- Sweep washing areas frequently to remove solid debris.
- Inspect and maintain sumps, oil/water separators, and on-site treatment/recycling units.

## **Supplemental Information**

### ***Design Considerations***

#### ***Designated Cleaning Areas***

- Washing operations outside should be conducted in a designated wash area having the following characteristics:
  - Paved with Portland cement concrete,
  - Covered and bermed to prevent contact with stormwater and contain wash water,
  - Sloped for wash water collection,
  - Equipped with an oil/water separator, if necessary.

## ***Examples***

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program's elements, including specific BMP guidance and lists of equipment suppliers, are applicable to industrial vehicle service facilities.

The U.S. Postal Service in West Sacramento has a new vehicle wash system that collects, filters, and recycles the wash water.

## **References and Resources**

<http://www.stormwatercenter.net/>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

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Photo Credit: Geoff Brosseau

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Description

Vehicle or equipment maintenance and repair is potentially a significant source of stormwater pollution, due to the use of materials and wastes created that are harmful to humans and the environment. Engine repair and service (e.g. parts cleaning), replacement of fluids (e.g. oil change), and outdoor equipment storage and parking (dripping engines) can impact water quality if stormwater runoff from areas with these activities occurring on them becomes polluted by a variety of contaminants.

Implementation of the following activities will prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment maintenance and repair activities.

## Approach

### Pollution Prevention

- Keep accurate maintenance logs to evaluate materials use.
- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Minimize use of solvents. Clean parts without using solvents whenever possible.
- Keep an accurate, up-to-date inventory of materials.
- Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.

## Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	

## Suggested Protocols





*General*

- Move maintenance and repair activities indoors whenever feasible.
- Store idle equipment containing fluids under cover.
- Use a vehicle maintenance area designed to prevent stormwater pollution - minimize contact of stormwater with outside operations through berming and appropriate drainage routing.
- Avoid hosing down your work areas. If work areas are washed, collect and direct wash water to sanitary sewer.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Post signs at sinks to remind employees, not to pour hazardous wastes down drains.
- Clean yard storm drain inlets(s) regularly.
- Do not pour materials down drains or hose down work areas; use dry sweeping.
- Cover the work area so as to limit exposure to the rain
- Place curbs around the immediate boundaries of the process equipment.
- Build a shed or temporary roof over areas where you park cars awaiting repair or salvage, especially if you handle wrecked vehicles. Build a roof over vehicles you keep for parts.

*Material and Waste Handling*

- Store materials and wastes under cover whenever possible.
- Designate a special area to drain and replace motor oil, coolant, and other fluids. This area should not have any connections to the storm drain or the sanitary sewer and should allow for easy clean up of drips and spills.
- Drain all fluids from wrecked vehicles immediately. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g. larger pans are needed to contain antifreeze, which may gush from some vehicles).
- Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- Do not dispose of used or leftover cleaning solutions, solvents, and automotive fluids and oil in the sanitary sewer.
- Dispose of all waste materials according to applicable laws and regulations.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.

- Promptly transfer used fluids to the proper waste or recycling drums and store in an appropriately designed area that can contain spills. Don't leave drip pans or other open containers lying around.
- Do not dispose of oil filters in trash cans or dumpsters, which may leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Most municipalities prohibit or discourage disposal of these items in solid waste facilities. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked and/or dead batteries in a non-leaking covered secondary container and dispose of properly at recycling or household hazardous waste facilities..

## *Maintenance and Repair Activities*

- Provide a designated area for vehicle maintenance.
- Keep equipment clean, don't allow excessive build-up of oil and grease.
- If temporary work is being conducted outside: Use a tarp, ground cloth, or drip pans beneath the vehicle or equipment to capture all spills and drips., The collected drips and spills must be disposed, reused, or recycled properly.
- If possible, perform all vehicle fluid removal or changing inside or under cover to prevent the runoff of stormwater and the runoff of spills:
  - Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, or remove other parts. Use a drip pan under any vehicle that might leak while you work on it to keep splatters or drips off the shop floor.
  - Promptly transfer used fluids to the proper waste or recycling drums. Don't leave drip pans or other open containers lying around.
  - Keep drip pans or containers under vehicles or equipment that might drip during repairs.
  - Do not change motor oil or perform equipment maintenance in non-appropriate areas.
- If equipment (e.g., radiators, axles) is to be stored outdoors, oil and other fluids should be drained first. This is also applicable to vehicles being stored and not used on a regular basis.
- Monitor parked vehicles closely for leaks and place pans under any leaks to collect the fluids for proper disposal or recycling.

## *Parts Cleaning*

- Clean vehicle parts without using liquid cleaners wherever possible to reduce waste.
- Do all liquid cleaning at a centralized station so the solvents and residues stay in one area.

- Discharge wastewater generated from steam cleaning and pressure washing to an appropriate treatment control that is connected to a blind sump. Non-caustic detergents should be used instead of caustic cleaning agents, detergent-based or water-based cleaning systems in place of organic solvent degreasers, and non-chlorinated solvent in place of chlorinated organic solvents for parts cleaning. Refer to SC-21 for more information on steam cleaning.
- Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse.

### *Inspection*

- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Make sure incoming vehicles are checked for leaking oil and fluids. Apply controls accordingly.

### *Training*

- Train employees and contractors in the proper handling and disposal of engine fluids and waste materials.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures (You can use reusable cloth rags to clean up small drips and spills instead of disposables; these can be washed by a permitted industrial laundry. Do not clean them at home or at a coin-operated laundry business). The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Use a training log or similar method to document training.

### *Spill Response and Prevention*

- Refer to SC-11 Spill Prevention, Control & Cleanup for more information.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Place adequate stockpiles of spill cleanup materials where they are readily accessible.
- Clean leaks, drips, and other spills with as little water as possible. Use rags for small spills, a damp mop for general cleanup, and dry absorbent material for larger spills. Use the following three-step method for cleaning floors:
  - Clean spills with rags or other absorbent materials
  - Sweep floor using dry absorbent material
  - Mop the floor. Mop water may be discharged to the sanitary sewer via a toilet or sink.
- Remove absorbent materials used for cleaning small spills promptly and properly.
- Do not saturate rags or absorbent material to eliminate need for disposal of spilled material as hazardous waste.



## ***Other Considerations***

- Space and time limitations may preclude all work being conducted indoors.
- It may not be possible to contain and clean up spills from vehicles/equipment brought onsite after working hours.
- Drain pans (usually 1 ft. x 1 ft.) are generally too small to contain antifreeze, so drip pans (3 ft. x 3 ft.) may have to be purchased or fabricated.
- Identification of engine leaks may require some use of solvents, which may require disposal as hazardous waste.
- Installation of structural treatment practices for pretreatment controls of wastewater discharges can be expensive.
- Prices for recycled materials and fluids may be higher than those of non-recycled materials.
- Some facilities can be limited by a lack of providers of recycled materials, and by the absence of businesses to provide services such as hazardous waste removal, structural treatment practice maintenance or solvent equipment and solvent recycling.

## **Requirements**

### ***Costs***

- Should be low, but will vary depending on the size of the facility.

### ***Maintenance***

- Sweep the maintenance area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Recycling***

Separating wastes allows for easier recycling and may reduce treatment costs. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents (e.g., 1,1,1-trichloroethane) separate from non-chlorinated solvents (e.g., kerosene and mineral spirits).

Many products made of recycled (i.e., refined or purified) materials are available. Engine oil, transmission fluid, antifreeze, and hydraulic fluid are available in recycled form. Buying recycled products supports the market for recycled materials.

- Recycling is always preferable to disposal of unwanted materials.
- Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
- Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries).



- Purchase recycled products to support the market for recycled materials.

#### *Safer Alternatives*

If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

- Use non-caustic detergents instead of caustic cleaning for parts cleaning.
- Use detergent-based or water-based cleaning systems in place of organic solvent degreasers. Wash water may require treatment before it can be discharged to the sewer.
- 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 list of active ingredients to see whether it contains chlorinated solvents.
- Choose cleaning agents that can be recycled.
- Refer to SC-61 Safer Alternative Products fact sheet for more information.

#### **References and Resources**

DTSC Doc. No. 619a Switching to Water Based Cleaners

DTSC Doc. No. 621 <http://www.stormwatercenter.net/>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Model Urban Runoff Program: A How-To-Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Orange County Stormwater Program

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San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -

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## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Loading and unloading of material may include package products, barrels, and bulk products. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

## Approach

### *Pollution Prevention*

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of materials with the potential to contaminate stormwater.
- Prevent stormwater runoff.
- Regularly check equipment for leaks.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



***Suggested Protocols******Loading and Unloading – General Guidelines***

- Develop an operations plan that describes procedures for loading and/or unloading.
- Do not conduct loading and unloading during wet weather, whenever possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- A seal or door skirt between delivery vehicles and building can reduce or prevent exposure to rain.
- Design loading/unloading area to prevent stormwater runoff which would include grading or berming the area, and positioning roof downspouts so they direct stormwater away from the loading/unloading areas.
- If feasible, load and unload all materials and equipment in covered areas such as building overhangs at loading docks.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm the loading/ unloading area to a drain that is connected to a dead-end sump.

***Inspection***

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

***Training***

- Train employees (e.g. fork lift operators) and contractors on proper spill containment and cleanup.
- Employees trained in spill containment and cleanup should be present during the loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.



- Make sure forklift operators are properly trained on loading and unloading procedures.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your spill prevention Control and countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Space, material characteristics and/or time limitations may preclude all transfers from being performed indoors or under cover.

## **Requirements**

### ***Costs***

- Should be low except when covering a large loading/unloading area.

### ***Maintenance***

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Regular broom dry-sweeping of area.
- Conduct major clean-out of loading and unloading area and sump prior to October 1 of each year.

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Special Circumstances for Indoor Loading/Unloading of Materials***

As appropriate loading or unloading of liquids should occur indoors so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - Transfer area should be designed to prevent runoff of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.



- Transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer (if allowed). A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

**References and Resources**

<http://www.stormwatercenter.net/>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

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## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Description

Accidental releases of materials from above ground liquid storage tanks, drums, and dumpsters present the potential for contaminating stormwaters with many different pollutants. Tanks may store many potential stormwater runoff pollutants, such as gasoline, aviation gas, diesel fuel, ammonia, solvents, syrups, etc. Materials spilled, leaked, or lost from storage tanks may accumulate in soils or on other surfaces and be carried away by rainfall runoff. These source controls apply to containers located outside of a building used to temporarily store liquid materials and include installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

## Approach

### Pollution Prevention

- Educate employees about pollution prevention measures and goals
- Keep an accurate, up-to-date inventory of the materials delivered and stored on-site. Re-evaluate inventory needs and consider purchasing alternative products. Properly dispose of outdated products.
- Try to keep chemicals in their original containers, and keep them well labeled.

## Targeted Constituents

Sediment	
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑



***Suggested Protocols******General***

- Develop an operations plan that describes procedures for loading and/or unloading. Refer to SC-30 Outdoor Loading/Unloading for more detailed BMP information pertaining to loading and unloading of liquids.
- Protect materials from rainfall, runoff, and wind dispersal:
  - Cover the storage area with a roof.
  - Minimize stormwater runoff by enclosing the area or building a berm around it.
  - Use a “doghouse” structure for storage of liquid containers.
  - Use covered dumpsters for waste product containers.
- Employ safeguards against accidental releases:
  - Provide overflow protection devices to warn operator or automatic shut down transfer pumps.
  - Provide protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage, and
  - Provide clear tagging or labeling, and restricting access to valves to reduce human error.
- Berm or surround tank or container with secondary containment system using dikes, liners, vaults, or double walled tanks.
- Contact the appropriate regulatory agency regarding environmental compliance for facilities with “spill ponds” designed to intercept, treat, and/or divert spills.
- Have registered and specifically trained professional engineers can identify and correct potential problems such as loose fittings, poor welding, and improper or poorly fitted gaskets for newly installed tank systems.

***Storage Areas***

- Provide storage tank piping located below product level with a shut-off valve at the tank; ideally this valve should be an automatic shear valve with the shut-off located inside the tank.
- Provide barriers such as posts or guard rails, where tanks are exposed, to prevent collision damage with vehicles.
- Provide secure storage to prevent vandalism.
- Place tight-fitting lids on all containers.
- Enclose or cover the containers where they are stored.



- Raise the containers off the ground by use of pallet or similar method, with provisions for spill control and secondary containment.
- Contain the material in such a manner that if the container leaks or spills, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters or groundwater.
- Place drip pans or absorbent materials beneath all mounted container taps, and at all potential drip and spill locations during filling and unloading of containers. Drip pans must be cleaned periodically, and all collected liquids and soiled absorbent materials must be reused/recycled or properly disposed.
- Ensure that any underground or aboveground storage tanks shall be designed and managed in accordance with applicable regulations, be identified as a potential pollution source, have secondary containment, such as a berm or dike with an impervious surface.
- Rainfall collected in secondary containment system must not contain pollutants for discharge to storm drain system.

## *Container Management*

- Keep containers in good condition without corrosion or leaky seams.
- Place containers in a lean-to structure or otherwise covered to keep rainfall from reaching the drums.
- Replace containers if they are deteriorating to the point where leakage is occurring. Keep all containers undercover to prevent the entry of stormwater. Employees should be made aware of the importance of keeping the containers free from leaks.
- Keep waste container drums in an area such as a service bay. Drums stored outside must be stored in a lean-to type structure, shed or walk-in container.

## *Storage of Hazardous Materials*

- Storage of reactive, ignitable, or flammable liquids must comply with the fire and hazardous waste codes.
- Place containers in a designated area that is paved, free of cracks and gaps, and impervious in order to contain leaks and spills. The area should also be covered.
- Surround stored hazardous materials and waste with a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain and a dead-end sump should be installed in the drain.

## *Inspection*

- Provide regular inspections:
  - Inspect storage areas regularly for leaks or spills.



- Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Replace containers that are leaking, corroded, or otherwise deteriorating with ones in good condition. If the liquid chemicals are corrosive, containers made of compatible materials must be used instead of metal drums.
- Label new or secondary containers with the product name and hazards.

***Training***

- Train employees (e.g. fork lift operators) and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Train employees in proper storage measures.
- Use a training log or similar method to document training.

***Spill Response and Prevention***

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Employees trained in emergency spill cleanup procedures should be present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Operator errors can be prevented by using engineering safe guards and thus reducing accidental releases of pollutant.
- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area.
- See Aboveground Tank Leak and Spill Control section of the Spill Prevention, Control & Cleanup fact sheet (SC-11) for additional information.

## ***Other Considerations***

- Storage sheds often must meet building and fire code requirements.
- The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.
- All specific standards set by federal and state laws concerning the storage of oil and hazardous materials must be met.
- Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code.
- Storage of oil and hazardous materials must meet specific federal and state standards including:
  - Spill Prevention Control and Countermeasure Plan (SPCC) Plan
  - Secondary containment
  - Integrity and leak detection monitoring
  - Emergency preparedness plans

## **Requirements**

### ***Costs***

- Will vary depending on the size of the facility and the necessary controls, such as berms or safeguards against accidental controls.

### ***Maintenance***

- Conduct weekly inspection.
- Sweep and clean the storage area regularly if it is paved, do not hose down the area to a storm drain.

## **Supplemental Information**

- The most common causes of unintentional releases are:
  - Installation problems,
  - Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves),
  - External corrosion and structural failure,
  - Spills and overfills due to operator error, and
  - Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

***Further Detail of the BMP******Dikes***

One of the best protective measures against contamination of stormwater is diking. Containment dikes are berms or retaining walls that are designed to hold spills. Diking is an effective pollution prevention measure for above ground storage tanks and railcar or tank truck loading and unloading areas. The dike surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater side of the dike area. Diking can be used in any industrial or municipal facility, but it is most commonly used for controlling large spills or releases from liquid storage areas and liquid transfer areas.

- For single-wall tanks, containment dikes should be large enough to hold the contents of the storage tank for the facility plus rain water.
- For trucks, diked areas should be capable of holding an amount equal to the volume of the tank truck compartment. Diked construction material should be strong enough to safely hold spilled materials.
- Dike materials can consist of earth, concrete, synthetic materials, metal, or other impervious materials.
- Strong acids or bases may react with metal containers, concrete, and some plastics.
- Where strong acids or bases are stored, alternative dike materials should be considered. More active organic chemicals may need certain special liners for dikes.
- Dikes may also be designed with impermeable materials to increase containment capabilities.
- Dikes should be inspected during or after significant storms or spills to check for washouts or overflows.
- Regular checks of containment dikes to insure the dikes are capable of holding spills should be conducted.
- Inability of a structure to retain stormwater, dike erosion, soggy areas, or changes in vegetation indicate problems with dike structures. Damaged areas should be patched and stabilized immediately.
- Accumulated stormwater in the containment area should be analyzed for pollutants before it is released to surface waters. If pollutants are found or if stormwater quality is not determined, then methods other than discharging to surface waters should be employed (e.g., discharge to sanitary sewer if allowed).
- Earthen dikes may require special maintenance of vegetation such as mulching and irrigation.



## *Curbing*

Curbing is a barrier that surrounds an area of concern. Curbing is similar to containment diking in the way that it prevents spills and leaks from being released into the environment. The curbing is usually small scaled and does not contain large spills like diking. Curbing is common at many facilities in small areas where handling and transfer liquid materials occur. Curbing can redirect stormwater away from the storage area. It is useful in areas where liquid materials are transferred from one container to another. Asphalt is a common material used for curbing; however, curbing materials include earth, concrete, synthetic materials, metal, or other impenetrable materials.

- Spilled materials should be removed immediately from curbed areas to allow space for future spills.
- Curbs should have manually-controlled pump systems rather than common drainage systems for collection of spilled materials.
- The curbed area should be inspected regularly to clear clogging debris.
- Maintenance should also be conducted frequently to prevent overflow of any spilled materials as curbed areas are designed only for smaller spills.
- Curbing has the following advantages:
  - Excellent runoff control,
  - Inexpensive,
  - Ease of installment,
  - Provides option to recycle materials spilled in curb areas, and
  - Common industry practice.

## ***Examples***

The “doghouse” design has been used to store small liquid containers. The roof and flooring design prevent contact with direct rain or runoff. The doghouse has two solid structural walls and two canvas covered walls. The flooring is wire mesh about secondary containment. The unit has been used successfully at Lockheed Missile and Space Company in Sunnyvale.

## **References and Resources**

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000  
<http://www.nalms.org/bclss/storage.html>

King County Stormwater Pollution Control Manual –  
<http://dnr.metrokc.gov/wlr/dss/spcm.htm>



San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>

## Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, solid waste treatment and disposal, are examples of process operations that can lead to contamination of stormwater runoff. Source controls for outdoor process equipment operations and maintenance include reducing the amount of waste created, enclosing or covering all or some of the equipment, installing secondary containment, and training employees.

## Approach

### *Pollution Prevention*

- Perform the activity during dry periods.
- Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.

### *Suggested Protocols*

- Consider enclosing the activity in a building and connecting the floor drains to the sanitary sewer.
- Cover the work area with a permanent roof.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (runon prevention). If allowed, connect process equipment area to public sewer.
- Dry clean the work area regularly.

### *Training*

- Train employees to perform the activity during dry periods only and to use less or non-toxic materials.
- Train employee and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	



# SC-32 Outdoor Equipment Maintenance

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## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your spill prevention control and countermeasure (SPCC) plan up-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Space limitations may preclude enclosing some equipment.
- Storage sheds often must meet building and fire code requirements.

## **Requirements**

### ***Costs***

- Costs vary depending on the complexity of the operation and the amount of control necessary for stormwater pollution control.
- Providing cover may be expensive.

### ***Maintenance***

- Conduct routine preventive maintenance, including checking process equipment for leaks.
- Clean the storm drain system regularly.

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Hydraulic/Treatment Modifications***

In some cases it may be necessary to capture and treat polluted stormwater. If the municipality does not have its own process wastewater treatment system, consider discharging to the public sewer system. Use of the public sewer might be allowed under the following conditions:

- If the activity area is very small (less than a few hundred square feet), the local sewer authority may be willing to allow the area to remain uncovered with the drain connected to the public sewer.
- It may be possible under unusual circumstances to connect a much larger area to the public sewer, as long as the rate of stormwater discharges does not exceed the capacity of the wastewater treatment plant. The stormwater could be stored during the storm and then transferred to the public sewer when the normal flow is low, such as at night.

## **References and Resources**

California's Nonpoint Source Program Plan <http://www.swrcb.ca.gov/nps/index.html>

# **Outdoor Equipment Maintenance      SC-32**

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Clark County Stormwater Pollution Control Manual  
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Stormwater Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Santa Clara Valley Urban Runoff Pollution Prevention Program <http://www.scvurppp.org>

The Stormwater Managers Resource Center <http://www.stormwatercenter.net/>



# Outdoor Storage of Raw Materials SC-33



## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Description

Raw materials, by-products, finished products, containers, and material storage areas exposed to rain and/or runoff can pollute stormwater. Stormwater can become contaminated when materials wash off or dissolve into water or are added to runoff by spills and leaks. Improper storage of these materials can result in accidental spills and the release of materials. To prevent or reduce the discharge of pollutants to stormwater from material delivery and storage, pollution prevention and source control measures, such as minimizing the storage of hazardous materials on-site, enclosing or covering materials, storing materials in a designated area, installing secondary containment, conducting regular inspections, preventing stormwater runoff and runoff, and training employees and subcontractors must be implemented.

## Approach

### *Pollution Prevention*

- Employee education is paramount for successful BMP implementation.
- Minimize inventory of raw materials.
- Keep an accurate, up-to-date inventory of the materials delivered and stored on-site.
- Try to keep chemicals in their original containers, and keep them well labeled.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



# SC-33 Outdoor Storage of Raw Materials

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## *Suggested Protocols*

### *General*

- Store all materials inside. If this is not feasible, then all outside storage areas should be covered with a roof, and bermed, or enclosed to prevent stormwater contact. At the very minimum, a temporary waterproof covering made of polyethylene, polypropylene or hypalon should be used over all materials stored outside.
- Cover and contain the stockpiles of raw materials to prevent stormwater from running into the covered piles. The covers must be in place at all times when work with the stockpiles is not occurring. (applicable to small stockpiles only).
- If the stockpiles are so large that they cannot feasibly be covered and contained, implement erosion control practices at the perimeter of your site and at any catch basins to prevent erosion of the stockpiled material off site,
- Keep liquids in a designated area on a paved impervious surface within a secondary containment.
- Keep outdoor storage containers in good condition.
- Keep storage areas clean and dry.
- Design paved areas to be sloped in a manner that minimizes the pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5 percent is recommended.
- Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use.
- Cover wood products treated with chromated copper arsenate, ammonical copper zinc arsenate, creosote, or pentachlorophenol with tarps or store indoors.

### *Raw Material Containment*

- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items in secondary containers if applicable.
- Prevent the run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the stockpile areas, by placing a curb along the perimeter of the area. The area inside the curb should slope to a drain. Liquids should be drained to the sanitary sewer if allowed. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Tanks should be bermed or surrounded by a secondary containment system.
- Release accumulated stormwater in petroleum storage areas prior to the next storm. At a minimum, water should pass through an oil/water separator and, if allowed, discharged to a sanitary sewer.

# Outdoor Storage of Raw Materials SC-33

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## *Inspection*

- Conduct regular inspections of storage areas so that leaks and spills are detected as soon as possible.
- Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.

## *Training*

- Employees should be well trained in proper material storage.
- Train employees and contractors in proper techniques for spill containment and cleanup.

## *Spill Response and Prevention*

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.
- Have employees trained in spill containment and cleanup present during loading/unloading of dangerous waste, liquid chemicals and other potentially hazardous materials.

## *Other Considerations*

- Storage sheds often must meet building and fire code requirements. Storage of reactive, ignitable, or flammable liquids must comply with the Uniform Fire Code and the National Electric Code.
- Space limitations may preclude storing some materials indoors.
- Some municipalities require that secondary containment areas (regardless of size) be connected to the sanitary sewer, prohibiting any hard connections to the storm drain. Storage sheds often must meet building and fire code requirements.
- The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.



# SC-33 Outdoor Storage of Raw Materials

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## Requirements

### *Costs*

- Costs will vary depending on the size of the facility and the necessary controls. They should be low except where large areas may have to be covered.

### *Maintenance*

- Accurate and up-to-date inventories should be kept of all stored materials.
- Berms and curbs may require periodic repair and patching.
- Parking lots or other surfaces near bulk materials storage areas should be swept periodically to remove debris blown or washed from storage area.
- Sweep paved storage areas regularly for collection and disposal of loose solid materials, do not hose down the area to a storm drain or conveyance ditch.
- Keep outdoor storage areas in good condition (e.g. repair roofs, floors, etc. to limit releases to runoff).

## Supplemental Information

### *Further Detail of the BMP*

#### *Raw Material Containment*

Paved areas should be sloped in a manner that minimize the pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5 percent is recommended.

- Curbing should be placed along the perimeter of the area to prevent the runoff of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the stockpile areas.
- The storm drainage system should be designed to minimize the use of catch basins in the interior of the area as they tend to rapidly fill with manufacturing material.
- The area should be sloped to drain stormwater to the perimeter where it can be collected or to internal drainage alleyways where material is not stockpiled.
- If the raw material, by-product, or product is a liquid, more information for outside storage of liquids can be found under SC-31, Outdoor Container Storage.

### *Examples*

The “doghouse” design has been used to store small liquid containers. The roof and flooring design prevent contact with direct rain or runoff. The doghouse has two solid structural walls and two canvas covered walls. The flooring is wire mesh about secondary containment. The unit has been used successively at Lockheed Missile and Space Company in Sunnyvale.

## References and Resources

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>



# **Outdoor Storage of Raw Materials SC-33**

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Model Urban Runoff Program: A How-To-Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, re-use, and recycling; and preventing runoff and runoff.

## Approach

### *Pollution Prevention*

- Reduction in the amount of waste generated can be accomplished using the following source controls such as:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



***Suggested Protocols******General***

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater runoff and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

***Controlling Litter***

- Post “No Littering” signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

***Waste Collection***

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage or leaks regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Place waste containers under cover if possible.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be

disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

## *Good Housekeeping*

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g. sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil storm drains on the facility's property with prohibitive message regarding waste disposal.

## *Chemical/Hazardous Wastes*

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers protected from vandalism, and in compliance with fire and hazardous waste codes.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.

## *Runon/Runoff Prevention*

- Prevent stormwater runon from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent the waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

## *Inspection*



- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

***Training***

- Train staff pollution prevention measures and proper disposal methods.
- Train employees and contractors proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Train employees and subcontractors in proper hazardous waste management.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.
- Vehicles transporting waste should have spill prevention equipment that can prevent spills during transport. The spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

***Other Considerations***

- Hazardous waste cannot be re-used or recycled; it must be disposed of by a licensed hazardous waste hauler.

**Requirements*****Costs***

- Capital and operation and maintenance costs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

***Maintenance***

- None except for maintaining equipment for material tracking program.

## Supplemental Information

### *Further Detail of the BMP*

#### *Land Treatment System*

- Minimize the runoff of polluted stormwater from land application of municipal waste on-site by:
  - Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, there is a closed drainage system.
  - Avoiding application of waste to the site when it is raining or when the ground is saturated with water.
  - Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site.
  - Maintaining adequate barriers between the land application site and the receiving waters. Planted strips are particularly good.
  - Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins.
  - Performing routine maintenance to ensure the erosion control or site stabilization measures are working.

## References and Resources

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Associations (BASMAA). On-line: <http://www.basmaa.org>



## Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, and abnormal pH. Utilizing the following protocols will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

## Approach

### *Pollution Prevention*

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.
- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>





# SC-41 Building & Grounds Maintenance

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## ***Suggested Protocols***

### *Pressure Washing of Buildings, Rooftops, and Other Large Objects*

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a waste water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash water runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement. Ensure that this practice does not kill grass.

### *Landscaping Activities*

- Do not apply any chemicals (insecticide, herbicide, or fertilizer) directly to surface waters, unless the application is approved and permitted by the state.
- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.
- Check irrigation schedules so pesticides will not be washed away and to minimize non-stormwater discharge.

### *Building Repair, Remodeling, and Construction*

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.



- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.
- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. In which case you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover with secondary containment during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

## *Mowing, Trimming, and Planting*

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water; do not put it in the storm drain, pour over landscaped areas.
- Use hand or mechanical weeding where practical.

## *Fertilizer and Pesticide Management*

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Follow manufacturers' recommendations and label directions. Pesticides must never be applied if precipitation is occurring or predicted. Do not apply insecticides within 100 feet of surface waters such as lakes, ponds, wetlands, and streams.
- Use less toxic pesticides that will do the job, whenever possible. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

# **SC-41      Building & Grounds Maintenance**

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- Apply pesticides only when wind speeds are low.
- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

## ***Inspection***

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.

## ***Training***

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Alternative pest/weed controls may not be available, suitable, or effective in many cases.

## Requirements

### *Costs*

- Overall costs should be low in comparison to other BMPs.

### *Maintenance*

- Sweep paved areas regularly to collect loose particles, and wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

## Supplemental Information

### *Further Detail of the BMP*

#### *Fire Sprinkler Line Flushing*

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping but it is subject to rusting and results in lower quality water. Initially the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time, typically a year, between flushes and may accumulate iron, manganese, lead, copper, nickel and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

## References and Resources

California's Nonpoint Source Program Plan <http://www.swrcb.ca.gov/nps/index.html>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASSMA) <http://www.basmaa.org/>

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA) <http://www.basmaa.org/>

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -  
<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



# Parking/Storage Area Maintenance SC-43



## Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The following protocols are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

## Approach

### *Pollution Prevention*

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook).
- Keep accurate maintenance logs to evaluate BMP implementation.

### *Suggested Protocols*

#### *General*

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>





# **SC-43 Parking/Storage Area Maintenance**

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- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

## *Controlling Litter*

- Post “No Littering” signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel and dispose of litter in the trash.

## *Surface cleaning*

- Use dry cleaning methods (e.g. sweeping or vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- If water is used follow the procedures below:
  - Block the storm drain or contain runoff.
  - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- When cleaning heavy oily deposits:
  - Use absorbent materials on oily spots prior to sweeping or washing.
  - Dispose of used absorbents appropriately.

## *Surface Repair*

- Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc., where applicable. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

# **Parking/Storage Area Maintenance SC-43**

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- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

## ***Inspection***

- Have designated personnel conduct inspections of the parking facilities and stormwater conveyance systems associated with them on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

## ***Training***

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

## **Requirements**

### ***Costs***

Cleaning/sweeping costs can be quite large, construction and maintenance of stormwater structural controls can be quite expensive as well.

### ***Maintenance***

- Sweep parking lot to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities on a regular basis to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

# SC-43 Parking/Storage Area Maintenance

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## Supplemental Information

### *Further Detail of the BMP*

#### *Surface Repair*

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Use only as much water as necessary for dust control, to avoid runoff.

## References and Resources

<http://www.stormwatercenter.net/>

California's Nonpoint Source Program Plan <http://www.swrcb.ca.gov/nps/index.html>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA) <http://www.basma.org>

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>





## Description

Over-water activities occur at boat and ship repair yards, marinas, and yacht clubs. The discharge of pollutants to receiving waters during these activities can be prevented or reduced by minimizing over-water maintenance, keeping wastes out of the water, cleaning up spills and wastes immediately, and educating tenants and employees.

## Approach

### Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Minimize use of solvents. Clean parts without using solvents whenever possible.
- Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible

### Suggested Protocols

#### General

- Perform paint and solvent mixing, fuel mixing, and similar handling of liquids on-shore, to avoid spillage directly in surface water bodies.
- Post signs to indicate proper use and disposal of residual paints, rags, used oil, and other engine fluids.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>





- Sweep dry docks before flooding.

#### *On Board Maintenance*

- Move maintenance and repair activities on-shore if possible. This action reduces some of the potential for direct pollution on water bodies.
- Used antifreeze should be stored in a separate, labeled drum and recycled.
- Fuel tank vents should have valves to prevent fuel overflows or spills.
- Boats with inboard engines should have oil absorption pads in bilge areas that should be changed when no longer useful or at least once a year.
- Careful consideration must be given to fueling boat engines, recycling used oil, and discarding worn motor parts into proper receptacles to prevent spills.
- Keeping boat motors well-tuned prevents fuel and lubricant leaks and improves fuel efficiency.

#### *Cleaning, Chipping, and Painting*

- Shelter any blasting and spray painting activities by hanging wind blocking tarps to prevent sand blasting dust and overspray from escaping.
- Use secondary containment on paint cans.
- Limit over-water hull surface maintenance to sanding and minor painting.
- Major hull resurfacing should occur on land.
- Use ground cloths when painting boats on land.
- Paint mixing should not occur on the dock
- Vacuuming up loose paint chips and paint dust can help to prevent paint and other chemical substances from entering waters.
- Properly dispose of surface chips, used blasting sand, residual paints, and other materials. Use temporary storage containment that is not exposed to rain.
- Use phosphate-free and biodegradable detergents for hull washing.
- Select nontoxic cleaning products that do not harm humans or aquatic life

#### *Disposal of Bilge Water, Ballast Water, and Wastewater*

- Collect bilge and ballast water that has an oily sheen on the surface for proper disposal rather than dumping in water or on land.
- Collect and properly dispose of wash water from washing painted boat hulls. Consider taking the boat to a local boat yard that is equipped to collect and treat wash water.

- Pump bilge water discharged at sea through an oil/water separator first and store the oil for discharge into storage tanks on shore for treatment.
- Pump bilge water into storage tanks on shore for analysis, treatment and proper disposal.
- Properly dispose of domestic wastewater and ballast water. DO NOT ALLOW discharge of treated or untreated sewage from vessels to harbors.
- Fecal matter and other solid waste should be contained in a U.S. Coast Guard-approved marine sanitation device (MSD).
- Portable toilets should be emptied into approved shore side waste handling facilities, and MSDs should be discharged into approved pump out stations.
- Avoid the intake of ballast water in shallow water or areas where bottom sediments are suspended.
- Avoid the intake of ballast water where there is an algal bloom in progress.
- Use as fine a filter as is practical on the ballast water intake ports to eliminate as many organisms and as much particulate matter as possible. Tests have been conducted using 300 micron followed by a 25 micron filter on intakes to see how well they work and hold up in practice.
- Dump estuarine or harbour ballast water at sea and take in fresh high salinity water to eliminate both pollutants and estuarine organisms.
- Ballast water may be discharged into large tanks on shore where it is treated, although the large volumes involved make this a very expensive and logistically difficult option.
- Ballast water may also be discharged into specially outfitted tanker ships which meet incoming ships and take in their ballast water for treatment and discharge of the clean water. The sludge produced would still have to be taken ashore for treatment or disposal. This is also an expensive and logistically difficult process.
- Carry out physical or chemical sterilization or neutralization of ballast water in situ, and subsequent neutralization of the sterilant, if required, before discharge.

## ***Training***

- Provide regular training to employees and/or contractors regarding stormwater BMPs for over water activities.
- Train employees and contractors in proper techniques for spill containment and cleanup.

***Spill Response and Prevention***

- Refer to Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Place an adequate stockpile of spill cleanup materials where it will be readily accessible. Clean leaks, drips, and other spills with as little water as possible. Use rags for small spills, a damp mop for general cleanup, and dry absorbent material for larger spills.
- Store and maintain appropriate spill cleanup materials in a location known to all; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Clean up spills on docks or boats immediately.

***Other Considerations***

- Private tenants at marinas may resist restrictions on shipboard painting and maintenance. Existing contracts with tenants may not allow the owner to require that tenants abide by new rules that benefit water quality. Even biodegradable cleaning agents have been found to be toxic to fish.

**Requirements*****Costs***

- Most of the BMPs are of low and modest cost. Exceptions are stations for temporary storage of residual paints and engine fluids, and wastewater pumpout facilities.

***Maintenance***

- Sweep maintenance yard areas, docks and boat ramps weekly to collect sandblasting material, paint chips, oils, and other loose debris, do not hose down the area to the water or a storm drain.

**Supplemental Information*****Further Detail of the BMP***

- Best management practices for ballast water generally fall into three main categories:
  - Preventing Uptake at the Source - Generally harbors are a poor place to take in ballast water since they are often polluted and when shallow are high in suspended sediments. Open ocean water is a better source of ballast water.
  - Killing or Neutralization During the Voyage - The current fleet of cargo vessels are not built to carry out these processes. New ships should be designed for these kinds of activities but retrofitting may be impossible, difficult or expensive. Any residues or sludges arising from these procedures would have to be separated from the water and discharged on shore for treatment. Many of these processes would render the ballast tanks lethal to the crew and require them to be absolutely airtight and provisions would be necessary for purging and re-introducing a safe breathable atmosphere into the tanks.

- Treatment at the Destination - A further way to reduce the movement of alien organisms in ballast water is to avoid discharge of the ballast water into the destination environment.

## References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.

<http://www.nalms.org/bclss/bmphome.html#bmp>

King County Stormwater Pollution Control Manual

<http://www.dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



## Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

## Approach

### *Pollution Prevention*

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

### *Suggested Protocols*

#### *General*

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

***Training***

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

***Other Considerations***

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

## Requirements

### *Costs*

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

### *Maintenance*

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

## Supplemental Information

### *Further Detail of the BMP*

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

### *Examples*

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

## References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.

<http://www.nalms.org/bclss/bmphome.html#bmp>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Mateo STOPPP - (<http://stoppp.tripod.com/bmp.html>)



## Descriptions

Promote the use of less harmful products. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

## Approach

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests by methods that pose a lower risk to employees, the public, and the environment.
- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies
- Procedures
  - Standard operating procedures (SOPs)
  - Purchasing guidelines and procedures

## Objectives

- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	





- Bid packages (services and supplies)
- Materials
  - Preferred or approved product and supplier lists
  - Product and supplier evaluation criteria
  - Training sessions and manuals
  - Fact sheets for employees

***Training***

- Employees who handle potentially harmful materials in the use of safer alternatives.
- Purchasing departments should be encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.

***Regulations***

This BMP has no regulatory requirements. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements,
- Stormwater runoff sampling requirements,
- Training and licensing requirements, and
- Record keeping and reporting requirements.

***Equipment***

- There are no major equipment requirements to this BMP.

***Limitations***

- Alternative products may not be available, suitable, or effective in every case.

**Requirements*****Costs***

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.
- Some alternative products may be slightly more expensive than conventional products.

**Supplemental Information**

Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources listed below.

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Rerefined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps. All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.
- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting.

## ***Examples***

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

## **References and Resources**

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

### ***General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information***

California Department of Toxic Substances Control ([www.dtsc.ca.gov](http://www.dtsc.ca.gov))

California Integrated Waste Management Board ([www.ciwmb.ca.gov](http://www.ciwmb.ca.gov))

City of Santa Monica ([www.santa-monica.org/environment](http://www.santa-monica.org/environment))

City of Palo Alto ([www.city.palo-alto.ca.us/cleanbay](http://www.city.palo-alto.ca.us/cleanbay))

City and County of San Francisco, Department of the Environment  
([www.ci.sf.ca.us/sfenvironment](http://www.ci.sf.ca.us/sfenvironment))

Earth 911 ([www.earth911.org/master.asp](http://www.earth911.org/master.asp))

Environmental Finance Center Region IX ([www.greenstart.org/efc9](http://www.greenstart.org/efc9))

Flex Your Power ([www.flexyourpower.ca.gov](http://www.flexyourpower.ca.gov))

GreenBiz.com ([www.greenbiz.com](http://www.greenbiz.com))

Green Business Program ([www.abag.org/bayarea/enviro/gbus/gb.html](http://www.abag.org/bayarea/enviro/gbus/gb.html))

Pacific Industrial and Business Association ([www.piba.org](http://www.piba.org))

Sacramento Clean Water Business Partners ([www.sacstormwater.org](http://www.sacstormwater.org))

USEPA BMP fact sheet – Alternative products  
([http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll\\_2.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll_2.cfm))

USEPA Region IX Pollution Prevention Program ([www.epa.gov/region09/p2](http://www.epa.gov/region09/p2))

Western Regional Pollution Prevention Network ([www.westp2net.org](http://www.westp2net.org))

## ***Metals (mercury, copper)***

National Electrical Manufacturers Association - Environment, Health and Safety  
([www.nema.org](http://www.nema.org))

Sustainable Conservation ([www.suscon.org](http://www.suscon.org))

Auto Recycling Project

Brake Pad Partnership

## ***Pesticides and Chemical Fertilizers***

Bio-Integral Resource Center ([www.birc.org](http://www.birc.org))

California Department of Pesticide Regulation ([www.cdpr.ca.gov](http://www.cdpr.ca.gov))

University of California Statewide IPM Program ([www.ipm.ucdavis.edu/default.html](http://www.ipm.ucdavis.edu/default.html))

## ***Dioxins***

Bay Area Dioxins Project (<http://dioxin.abag.ca.gov/>)





## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>

## Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

## Approach

### Pollution Prevention

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

### Suggested Protocols

#### Street Sweeping and Cleaning

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.





- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

#### *Street Repair and Maintenance*

##### *Pavement marking*

- Schedule pavement marking activities for dry weather.

- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

## *Concrete installation and repair*

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place sand bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- 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.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

*Patching, resurfacing, and surface sealing*

- Schedule patching, resurfacing and surface sealing for dry weather.
- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.
- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.
- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.
- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.
- Use only as much water as necessary for dust control, to avoid runoff.
- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

*Equipment cleaning maintenance and storage*

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.
- Perform major equipment repairs at the corporation yard, when practical.
- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.
- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

*Bridge and Structure Maintenance**Paint and Paint Removal*

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Do not transfer or load paint near storm drain inlets or watercourses.



- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.
- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.
- Capture all clean-up water, and dispose of properly.
- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

## *Graffiti Removal*

- Schedule graffiti removal activities for dry weather.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.
- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.
- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

## *Repair Work*

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.
- Thoroughly clean up the job site when the repair work is completed.
- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.



- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

#### *Unpaved Roads and Trails*

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

#### *Non-Stormwater Discharges*

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

#### ***Training***

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

## **Requirements**

### ***Costs***

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between \$60,000 and \$120,000. Newer technologies might have prices approaching \$180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
  - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
  - Traffic control officers may be required to enforce parking restrictions.
  - Skillful design of cleaning routes is required for program to be productive.
  - Arrangements must be made for disposal of collected wastes.

- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

***Maintenance***

- Not applicable

**Supplemental Information*****Further Detail of the BMP******Street sweeping***

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

**Mechanical Broom Sweepers** - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

**Vacuum Sweepers** - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

**Street Flushers** - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

***Cross-Media Transfer of Pollutants***

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM<sub>10</sub>). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

***Bridges***

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.



- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.
- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.
- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

## *De-icing*

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.
- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.
- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

## **References and Resources**

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Fresh Concrete and Mortar Application Best Management Practices for the Construction Industry. June.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Roadwork and Paving Best Management Practices for the Construction Industry. June.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Roadway and Bridge Maintenance. On-line [http://www.epa.gov/npdes/menuofbmeps/poll\\_13.htm](http://www.epa.gov/npdes/menuofbmeps/poll_13.htm)





## Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

## Approach

### *Pollution Prevention*

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

## *Suggested Protocols*

### *Surface Cleaning*

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

#### *Graffiti Removal*

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

#### *Surface Removal and Repair*

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

#### *Concrete Installation and Repair*

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place sand bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- 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.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

## *Controlling Litter*

- Post “No Littering” signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

## *Training*

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

## *Spill Response and Prevention*

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.



***Other Considerations***

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewerage agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

**Requirements*****Costs***

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

***Maintenance***

Not applicable

**Supplemental Information*****Further Detail of the BMP***

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

**References and Resources**

Bay Area Stormwater Management Agencies Association (BASMAA). 1996. Pollution From Surface Cleaning Folder <http://www.basmaa.org>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.



Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Plan. 2001. Municipal Activities Model Program Guidance. November.

## Description

The primary pollutant of concern in municipal swimming pool water is chlorine or chloramine used as a disinfectant. This water, if discharged to the storm drain system, can be toxic to aquatic life. In lakes, lagoons, and fountains, the pollutants of concern are chemical algaecides that are added to control algae mainly for aesthetic reasons (visual and odor). Following the procedures noted in this fact sheet will reduce the pollutants in this discharge.

## Approach

### Pollution Prevention

- Prevent algae problems with regular cleaning, consistent adequate chlorine levels, and well-maintained water filtration and circulation systems.
- Manage pH and water hardness to minimize corrosion of copper pipes.

### Suggested Protocols

#### Pools and Fountains

- Do not use copper-based algaecides. Control algae with chlorine or other alternatives, such as sodium bromide.
- Do not discharge water to a street or storm drain when draining pools or fountains; discharge to the sanitary sewer if permitted to do so. If water is dechlorinated with a neutralizing chemical or by allowing chlorine to dissipate for a few days (do not use the facility during this time), the water may be recycled/reused by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present.
- Prevent backflow if draining a pool to the sanitary sewer by maintaining an "air gap" between the discharge line and the sewer line (do not seal the connection between the hose and sewer line). Be sure to call the local wastewater treatment plant for further guidance on flow rate restrictions, backflow prevention, and handling special cleaning waste (such as acid wash). Discharge flows should be kept to the low levels typically possible through a garden hose. Higher flow rates may be prohibited by local ordinance.
- Provide drip pans or buckets beneath drain pipe connections to catch leaks. This will be especially pertinent if pool or spa water that has not been dechlorinated is pumped through piping to a discharge location.

## Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



# SC-72      Fountains & Pools Maintenance

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- Never clean a filter in the street or near a storm drain.
- Rinse cartridge filters onto a dirt area, and spade filter residue into soil.
- Backwash diatomaceous earth filters onto dirt. Dispose of spent diatomaceous earth in the garbage. Spent diatomaceous earth cannot be discharged to surface waters, storm drainage systems, septic systems, or on the ground.
- If there is not a suitable dirt area discharge filter backwash or rinsewater to the sanitary sewer if permitted to do so by the local sewerage agency.

## *Lakes and Lagoons*

- Reduce fertilizer use in areas around the water body. High nitrogen fertilizers can produce excess growth requiring more frequent mowing or trimming, and may contribute to excessive algae growth.
- To control bacteria, discourage the public from feeding birds and fish (i.e. place signs that prohibit feeding of waterfowl).
- Consider introducing fish species that consume algae. Contact the California Department of Fish and Game for more information on this issue.
- Mechanically remove pond scum (blue-green algae) using a 60 micron net.
- Educate the public on algae and that no controls are necessary for certain types of algae that are beneficial to the water body.
- Control erosion by doing the following:
  - Maintain vegetative cover on banks to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of stormwater runoff.
  - Areas should be designed (sloped) to prevent runoff and erosion and to promote better irrigation practices.
  - Provide energy dissipaters (e.g. riprap) along banks to minimize potential for erosion.
  - Confine excavated materials to surfaces away from lakes. Material must be covered if rain is expected.
- Conduct inspections to detect illegal dumping of clippings/cuttings in or near a lake. Materials found should be picked up and properly disposed of.
- Avoid landscape wastes in and around lakes should be avoided by either using bagging equipment or by manually picking up the material. Collect trash and debris from within water bodies where feasible
- Provide and maintain trash receptacles near recreational water bodies to hold refuse generated by the public.



- Increase trash collection during peak visitation months (generally June, July and August).

## ***Training***

- Train maintenance personnel to test chlorine levels and to apply neutralizing chemicals.
- Train personnel regarding proper maintenance of pools, ponds and lakes.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Managers of pools located in sensitive areas or adjacent to shorelines should check with the appropriate authorities to determine if code requirements apply.
- Cleanup activities at lakes and lagoons may create a slight disturbance for local aquatic species. If the lake is recognized as a wetland, many activities, including maintenance, may be subject to regulation and permitting.

## **Requirements**

### ***Costs***

- The maintenance of pools and lakes is already a consideration of most municipal public works departments. Therefore the cost associated with this BMP is minimal and only reflects an increase in employee training and public outreach.

### ***Maintenance***

Not applicable

## **Supplemental Information**

### ***Further Detail of the BMP***

When dredging is conducted, adhere to the following:

- Dredge with shovels when laying/maintaining pipes.
- To determine amount to dredge, determine rate of volume loss due to sediments.
- For large lakes, dredge every 10 years.
- When dredging small lakes, drain lake.
- When dredging large lakes, use vacuum equipment.
- After dredging test sediment piles for proper disposal. Dredged sediment can be used as fill, or may have to be land filled.



# SC-72      Fountains & Pools Maintenance

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## References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line:  
<http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line:  
[http://ladpw.org/wmd/npdes/public\\_TC.cfm](http://ladpw.org/wmd/npdes/public_TC.cfm)

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Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.



## Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

## Approach

### Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

## Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	<input checked="" type="checkbox"/>



- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

***Suggested Protocols******Mowing, Trimming, and Weeding***

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

***Planting***

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

***Waste Management***

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.



- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

## ***Irrigation***

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

## ***Fertilizer and Pesticide Management***

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.



- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

### *Inspection*

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

### *Training*

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in “agricultural use” areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

## **Requirements**

### ***Costs***

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

### ***Maintenance***

Not applicable

**Supplemental Information*****Further Detail of the BMP******Waste Management***

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

***Contractors and Other Pesticide Users***

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

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Photo Credit: Geoff Brosseau

## Objectives

- Contain
- Educate
- Reduce/Minimize

## Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

## Approach

### *Suggested Protocols*

#### *Catch Basins/Inlet Structures*

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>





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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

## *Storm Drain Conveyance System*

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

## *Pump Stations*

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

## *Open Channel*

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a stream or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

## *Illicit Connections and Discharges*

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

## *Illegal Dumping*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

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- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

## ***Training***

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

## ***Spill Response and Prevention***

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.



- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

## Requirements

### *Costs*

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from “environmental fees” or special assessment districts to fund their illicit connection elimination programs.

### *Maintenance*

- Two-person teams may be required to clean catch basins with vactor trucks.
- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

## Supplemental Information

### *Further Detail of the BMP*

#### *Storm Drain flushing*

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents “plug flow” discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to



cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

### *Flow Management*

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows are allowed to spread out.

### *Stream Corridor Planning*

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for stream alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.



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When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to be reclaimed.

## **Examples**

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank and watershed instability and floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

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## Objectives

- Cover
- Contain
- Educate
- Reduce/Reuse

## Description

It is important to control litter to eliminate trash and other materials in stormwater runoff. Waste reduction is a major component of waste management and should be encouraged through training and public outreach. Management of waste once it is collected may involve reuse, recycling, or proper disposal.

## Approach

### *Pollution Prevention*

- Reuse products when possible.
- Encourage recycling programs with recycling bins, used oil collection, etc.

### *Suggested Protocols*

#### *Solid Waste Collection*

- Implement procedures, where applicable, to collect, transport, and dispose of solid waste at appropriate disposal facilities in accordance with applicable federal, state, and local laws and regulations.
- Include properly designed trash storage areas. If feasible provide cover over trash storage areas.
- Regularly inspect solid waste containers for structural damage. Repair or replace damaged containers as necessary.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
- Refer to SC-34 Waste Handling and Disposal for more information regarding solid waste facilities.

#### *Waste Reduction and Recycling*

- Recycle wastes whenever possible. Many types of waste can be recycled, recycling options for each waste type are limited. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should either be incinerated or disposed of at a properly permitted landfill.
- Recycling is always preferable to disposal of unwanted materials.
- Recycling bins for glass, metal, newspaper, plastic bottles and other recyclable household solid wastes should be provided at public facilities and/or for residential curbside collection.

#### *Controlling Litter*

- Post “No Littering” signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Clean out and cover litter receptacles frequently to prevent spillage.

#### *Illegal Dumping*

Substances illegally dumped on streets and into the storm drain system and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clipping, and pet wastes.

- Post “No Dumping” signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Landscaping and beautification efforts of hot spots might also discourage future dumping.
- See SC-74 Drainage System Maintenance, and SC-10 Non-Stormwater Discharges.

## Requirements

### *Costs*

- The costs for a solid waste source control program vary depending on the type of method. The cost of a community education program or a plan to increase the number of trash receptacles can be very minimal. Costs for structural controls such as trash racks, bar screens, and silt traps can be quite costly ranging from \$250,000 to \$900,000.
- A collection facility or curbside collection for used oil may result in significant costs. Commercial locations (automobile service stations, quick oil change centers, etc.) as collection points eliminate hauling and recycling costs.
- Collection and disposal of hazardous waste can be very expensive and requires trained operators; laboratory and detection equipment; and extensive record keeping including dates, types, and quantities.
- Use of volunteer work forces can lower storm drain stenciling program costs. Stenciling kits require procurement of durable/disposable items. The stenciling program can aid in the cataloging of the storm drain system. One municipality from the state of Washington has estimated that stenciling kits cost approximately \$50 each. Stencils may cost about \$8 each including the die cost on an order of 1,000. Re-orders cost about \$1/stencil. Stencil designs may be available from other communities. Stencil kits should be provided on a loan basis to volunteer groups free of charge with the understanding that kit remnants are to be returned.

### *Maintenance*

- The primary staff demand for stenciling programs is for program setup to provide marketing and training. Ongoing/follow-up staff time is minimal because of volunteer services.
- Staffing requirements are minimal for oil recycling programs if collection/recycling is contracted out to a used oil hauler/recycler or required at commercial locations.
- Staff requirements for maintaining good housekeeping BMPs at waste handling sites is minimal.

## Supplemental Information

### *Further Detail of the BMP*

#### *Waste Reduction*

An approach to reduce stormwater pollution from waste handling and disposal is to assess activities and reduce waste generation. The assessment is designed to find situations where waste can be eliminated or reduced and emissions and environmental damage can be minimized. The assessment involves collecting process specific information, setting pollution prevention targets, and developing, screening and selecting waste reduction options for further study. Starting a waste reduction program is economically beneficial because of reduced raw material purchases and lower waste disposal fees.



**References and Resources**

Best Management Practices Program for Pollution Prevention, City and County of San Francisco, Uribe & Associates, Oakland, California, 1990.

Harvard University. 2002. Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety.

Model Urban Runoff Program: A How-To-Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July 1998. (Revised February 2002 by the California Coastal Commission).

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp).

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

# Water & Sewer Utility Maintenance SC-76



## Objectives

- Contain
- Educate
- Reduce/Minimize

## Description

Although the operation and maintenance of public utilities are not considered chronic sources of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Sewage incident response and investigation may involve a coordinated effort between staff from a number of different departments/agencies. Cities that do not provide maintenance of water and sewer utilities must coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

## Approach

### *Pollution Prevention*

Inspect potential non-stormwater discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

### *Suggested Protocols*

#### *Water Line Maintenance and Cleaning*

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



# **SC-76 Water & Sewer Utility Maintenance**

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breaks, sheared fire hydrants, equipment malfunction, and operator error.

## *Planned discharges*

- Identify a suitable discharge option in the following order of preference:
  - Apply to the land.
  - Reuse water for dust suppression, irrigation, or construction compaction.
  - Discharge to a sanitary sewer system with approval.
  - Discharge to the storm drain system using applicable pollution control measures. (Only available to clean water discharges such as water main/ water storage tank/water hydrant flushing).
- If water is discharged to a storm drain, control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain protection options include:
  - Silt fence – appropriate where the inlet drains a relatively flat area.
  - Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
  - Wooden weir and fabric – use at curb inlets where a compact installation is desired.
- Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- General Design considerations for inlet protection devices include the following:
  - The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
  - Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.
- The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made.

## *Unplanned Discharges*

- Stop the discharge as quickly as possible.
- Inspect flow path of the discharged water:
  - Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions



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- Identify the potential for pollutants to be washed into the waterway
- If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path.

## *Sanitary Sewer Maintenance*

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by a municipality. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

- Clean sewer lines on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- Cleaning activities may require removal of tree roots and other identified obstructions.
- During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
  - Cracked/deteriorating pipes
  - Leaking joints/seals at manhole
  - Frequent line plugs
  - Line generally flows at or near capacity
  - Suspected infiltration or exfiltration.
- Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure.

## *Spills and Overflows*

- Identify and track sanitary sewer discharges. Identify dry weather infiltration and inflow first. Wet weather overflow connections are very difficult to locate.



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- Locate wet weather overflows and leaking sanitary sewers using conventional source identification techniques such as monitoring and field screening. Techniques used to identify other illicit connection sources can also be used for sewer system evaluation surveys (see SC74 Drainage System Operation and Maintenance).
- Implement community awareness programs for monitoring sanitary sewer wet weather overflows. A citizen's hotline for reporting observed overflow conditions should be established to supplement field screening efforts.
- Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- When a spill, leak, and/or overflow occurs and when disinfecting a sewage contaminated area, take every effort to ensure that the sewage, disinfectant and/or sewage treated with the disinfectant is not discharged to the storm drain system or receiving waters. Methods may include:
  - Blocking storm drain inlets and catch basins
  - Containing and diverting sewage and disinfectant away from open channels and other storm drain fixtures (using sandbags, inflatable dams, etc.)
  - Removing the material with vacuum equipment
- Record required information at the spill site.
- Perform field tests as necessary to determine the source of the spill.
- Develop notification procedures regarding spill reporting.

## ***Septic Systems***

- Ensure that homeowners, installers, and inspectors are educated in proper maintenance of septic systems. This may require coordination with staff from other departments. Outreach to homeowners should include inspection reminders informing them that inspection and perhaps maintenance is due for their systems. Recommend that the system be inspected annually and pumped-out regularly.
- Programs which seek to address failing septic systems should consider using field screening to pinpoint areas where more detailed onsite inspection surveys are warranted.

## ***Training***

- Conduct annual training of water utility personnel and service contractors. (field screening, sampling, smoke/dye testing, TV inspection).
- OSHA-required Health and Safety Training 29 CFR 1910.120 plus annual Refresher Training (as needed).
- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).

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## ***Spill Response and Prevention***

- See previous section regarding spills and overflows.
- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Enact ordinance granting “right-of-entry” to locate potentially responsible parties for sewer overflows.
- Reliance on individual onsite inspection to detect failed septic systems can be a major limitation. The individual onsite inspection is very labor-intensive and requires access to private property to pinpoint the exact location of the failing system.
- A significant limitation to correcting failing septic systems is the lack of techniques available for detecting individual failed septic systems.

## **Requirements**

### ***Costs***

- Departmental cooperation recommended for sharing or borrowing staff resources and equipment from municipal wastewater department.
- Infiltration, inflow, and wet weather overflows from sanitary sewers are very labor and equipment intensive to locate.
- The costs associated with detecting and correcting septic system failures are subject to a number of factors, including availability of trained personnel, cost of materials, and the level of follow-up required to fix the system problems.

### ***Maintenance***

- Minimum 2-person teams to perform field screening and associated sampling.
- Larger teams required for implementing other techniques (i.e. zinc chloride smoke testing, fluorometric dye testing, television camera inspection and physical inspection with confined space entry) to identify sewer system leaks.
- Program coordination required for handling emergencies, record keeping, etc.
- Many of the problems associated with improper use of septic systems may be attributed to lack of user knowledge on operation and maintenance. Educational materials for homeowners and training courses for installers and inspectors can reduce the incidence of pollution from these widespread and commonly used pollution control devices.

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## Supplemental Information

### *Further Detail of the BMP*

#### *Onsite Sewage Disposal Systems*

New onsite sewage disposal systems should be designed, located, and installed away from open waterbodies and sensitive resources such as wetlands and floodplains. A protective separation between the OSDS and groundwater should also be established. OSDSs should be operated and maintained to prevent surface water discharges and reduce pollutant loadings to groundwater. Inspection of OSDSs should occur regularly and repairs made immediately. New or replacement plumbing fixtures should be of the high efficiency type.

#### *Typical Sanitary Sewer Problems*

- Old and deteriorated main and lateral pipes - Sewers range in age from 30 to 100 years with an average age of 50 years.
- Cracked sewer pipes - Existing sewers are mostly clay pipes which can crack as they deteriorate with age and also by earth movement.
- Misaligned and open pipe joints - Most of the mortar used to seal the joints between sections of clay pipe has deteriorated.
- Undersized sewer pipe - The existing sewer system is overloaded due to new sewer hook-ups, underground water infiltration, and illegal roof and/or yard drain connections.
- Defective manholes - Old manholes are made of bricks. Typical problems associated with brick manholes are loose bricks, missing bricks, and misaligned manholes.
- Missing and/or unrecorded sewer pipes and manholes - This problem is typical in the easement/backline sewer. Sewer pipe locations shown on the sewer record map are different from the actual sewer location.
- Sewer main under houses and other improvements - Complaints of sewer main alignment crossing the house and other improvements. A solution to this problem requires an agreement with the property owner for a new sewer easement at a relocated line.

#### *Causes of Sanitary Sewer Backups*

- Root infiltration - Tree roots are a major cause of backups.
- Water inflow/infiltration - Rain water entering the sewer pipe causes overflows.
- Solids - Typical solids that buildup in the pipe and cause backups are grease, dirt, bones, tampons, paper towels, diapers, broken dishware, garbage, concrete, and debris.
- Structural defects in pipes and manholes - Sags in the line, cracks, holes, protruding laterals, misaligned pipe, offset joints are all possible causes of backups.



# Water & Sewer Utility Maintenance SC-76

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## *Design Considerations*

Sanitary sewer overflows can often be reduced or eliminated by a number of practices, in addition to sewer system cleaning and maintenance, including the following:

- Reducing infiltration and inflow through rehabilitation and repair of broken or leaking sewer lines.
- Enlarging or upgrading the capacity of sewer lines, pump stations, or sewage treatment plants.
- Constructing wet weather storage and treatment facilities to treat excess flows.
- Addressing SSOs during sewer system master planning and facilities planning.

## *Septic Systems*

Two field screening techniques that have been used with success at identifying possible locations of failing septic systems are the brightener test and color infrared (CIR) aerial photography. The first involves the use of specific phosphorus-based elements found in many laundry products, often called brighteners, as an indicator of the presence of failing onsite wastewater systems. The second technique uses color infrared (CIR) aerial photography to characterize the performance of septic systems. This method has been found to be a quick and cost-effective method for assessing the potential impacts of failing systems and uses variations in vegetative growth or stress patterns over septic system field lines to identify those systems that may potentially be malfunctioning. Then a more detailed onsite visual and physical inspection will confirm whether the system has truly failed and the extent of the repairs needed. These inspections may be carried out by county health departments or other authorized personnel.

## **References and Resources**

Alameda Countywide Clean Water Program on-line  
<http://www.ci.berkeley.ca.us/pw/Storm/stormala.html>

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line:  
[http://ladpw.org/wmd/npdes/public\\_TC.cfm](http://ladpw.org/wmd/npdes/public_TC.cfm)

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1998. Water Utility Operation and Maintenance Discharge Pollution Prevention Plan. June

United States Environmental Protection Agency (USEPA). 2001. Illicit Discharge Detection and Elimination. On-line: [http://cfpub.epa.gov/npdes/stormwater/menuofbmps/illi\\_1.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/illi_1.cfm)



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United States Environmental Protection Agency (USEPA). 2001. Pollution Prevention/Good Housekeeping for Municipal Operators Septic System Controls. On-line:  
[http://www.epa.gov/npdes/menuofbmps/poll\\_14.htm](http://www.epa.gov/npdes/menuofbmps/poll_14.htm)

# Section 4

## Treatment Control BMPs

### 4.1 Introduction

This section discusses the inspection and maintenance requirements for treatment control BMPs shown in Table 4-1. The specific design requirements, performance specifications, and limitations of each of these BMPs are discussed in detail in the New Development and Redevelopment BMP Handbook. Inspection and maintenance requirements are necessary to verify that each treatment control BMP performs efficiently throughout its design life. Although specific inspection and maintenance frequencies are presented in the following fact sheets, these are only suggested and should be adapted to each site situation to best accommodate environmental, economic, and local regulatory concerns.

For the purpose of this Handbook, treatment control BMPs have been classified according to whether they are public domain or proprietary controls. Public domain controls, as the name implies, are controls that are available to the general public, while proprietary controls are typically patented devices and are purchased from a vendor.

### 4.2 Fact Sheet Format

A BMP fact sheet is a short document that gives pertinent maintenance and inspection information about a particular treatment control BMP. Typically, each fact sheet contains the information outlined in Figure 4-1. Completed fact sheets for each of the treatment control BMPs shown in Table 4-1 are provided in Section 4.3.

The fact sheets also contain side bar presentations with information on BMP maintenance concerns, objectives, and goals; targeted constituents; and removal effectiveness if known.

Table 4-1 Treatment Control BMPs	
Public Domain	
TC-10	Infiltration Trench
TC-11	Infiltration Basin
TC-12	Retention/Irrigation
TC-20	Wet Pond
TC-21	Constructed Wetland
TC-22	Extended Detention Basin
TC-30	Vegetated Swale
TC-31	Vegetated Buffer Strip
TC-32	Bioretention
TC-40	Media Filter
TC-50	Water Quality Inlet
TC-60	Multiple Systems
Manufactured (Proprietary)	
MP-20	Wetland
MP-40	Media Filter
MP-50	Wet Vault
MP-51	Vortex Separator
MP-52	Drain Inlet

#### TC-xx Example Maintenance Fact Sheet

General Description

Inspection/Maintenance Considerations

Inspection Activities

Maintenance Activities

Additional Information

References

**Figure 4-1**  
**Example Fact Sheet**

## 4.3 BMP Fact Sheets

Maintenance BMP fact sheets for public domain and manufactured BMPs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusion in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at [www.cabmphandbooks.com](http://www.cabmphandbooks.com). As noted previously, the reader should refer to the New Development and Redevelopment BMP Handbook for details regarding BMP design, performance, and installation. In addition to the references at the end of each fact sheet, the 1993 version of the California Stormwater BMP Handbook was used as a general reference and starting point for the preparation of the maintenance fact sheets that follow.

In addition, it is worth noting that there are numerous proprietary treatment control devices available. Manufacturers typically have recommended inspection schedules and maintenance requirements for each device. If your facility utilizes proprietary treatment control devices for stormwater runoff, a maintenance agreement and detailed maintenance plan should be developed to ensure that they are well maintained, and operate according to design specifications. For many manufactured devices, municipalities can contract with the manufacturer or representative to provide maintenance services.





## Maintenance Concerns, Objectives, and Goals

- Accumulation of Metals
- Clogged Soil Outlet Structures
- Vegetation/Landscape Maintenance

## General Description

An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix. Infiltration trenches perform well for removal of fine sediment and associated pollutants. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of coarse sediment entering the trench which can clog and render the trench ineffective.

## Inspection/Maintenance Considerations

Frequency of clogging is dependant on effectiveness of pretreatment, such as vegetated buffer strips, at removing sediments. See appropriate maintenance factsheets for associated pretreatment. If the trench clogs, it may be necessary to remove and replace all or part of the filter fabric and possibly the coarse aggregate. Clogged infiltration trenches with surface standing water can become a nuisance due to mosquito breeding. Maintenance efforts associated with infiltration trenches should include frequent inspections to ensure that water infiltrates into the subsurface completely at a recommended infiltration rate of 72 hours or less to prevent creating mosquito and other vector habitats. Most of the maintenance should be concentrated on the pretreatment practices, such as buffer strips and swales upstream of the trench to ensure that sediment does not reach the infiltration trench. Regular inspection should determine if the sediment removal structures require routine maintenance. Infiltration trenches should not be put into operation until the upstream tributary area is stabilized.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	■
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after every major storm for the first few months to ensure proper functioning. Drain times should be observed to confirm that designed drain times has been achieved.</li> </ul>	After construction
<ul style="list-style-type: none"> <li>■ Inspect facility for signs of wetness or damage to structures, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, standing water, and material buildup.</li> <li>■ Check for standing water or, if available, check observation wells following 3 days of dry weather to ensure proper drain time.</li> <li>■ Inspect pretreatment devices and diversion structures for damage, sediment buildup, and structural damage.</li> </ul>	Semi-annual and after extreme events
<ul style="list-style-type: none"> <li>■ Trenches with filter fabric should be inspected for sediment deposits by removing a small section of the top layer. If inspection indicates that the trench is partially or completely clogged, it should be restored to its design condition.</li> </ul>	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Repair undercut and eroded areas at inflow and outflow structures.</li> <li>■ Remove sediment, debris, and oil/grease from pretreatment devices and overflow structures.</li> </ul>	Standard maintenance (as needed)
<ul style="list-style-type: none"> <li>■ Remove trash, debris, grass clippings, trees, and other large vegetation from the trench perimeter and dispose of properly.</li> <li>■ Mow and trim vegetation to prevent establishment of woody vegetation, and for aesthetic and vector reasons.</li> </ul>	Semi-annual, more often as needed
<ul style="list-style-type: none"> <li>■ Clean out sediment traps, forebays, inlet/outlet structures, overflow spillway, and trenches if necessary.</li> <li>■ Remove grass clippings, leaves, and accumulated sediment from the surface of the trench. Replace first layer of aggregate and filter fabric if clogging appears only to be at the surface.</li> <li>■ Clean trench when loss of infiltrative capacity is observed. If drawdown time is observed to have increased significantly over the design drawdown time, removal of sediment may be necessary. This is an expensive maintenance activity and the need for it can be minimized through prevention of upstream erosion.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ If bypass capability is available, it may be possible to regain the infiltration rate in the short term by providing an extended dry period.</li> <li>■ Seed or sod to restore ground cover.</li> </ul>	5-year maintenance
<ul style="list-style-type: none"> <li>■ Total rehabilitation of the trench should be conducted to maintain storage capacity within 2/3 of the design treatment volume and 72-hour exfiltration rate limit.</li> <li>■ Trench walls should be excavated to expose clean soil.</li> <li>■ All of the stone aggregate and filter fabric or media must be removed. Accumulated sediment should be stripped from the trench bottom. At this point the bottom may be scarified or tilled to help induce infiltration. New fabric and clean stone aggregate should be refilled.</li> </ul>	Upon failure

## Additional Information

Infiltration practices have historically had a high rate of failure compared to other stormwater management practices. One study conducted in Prince George's County, Maryland (Galli, 1992), revealed that less than half of the infiltration trenches investigated (of about 50) were still functioning properly, and less than one-third still functioned properly after 5 years. Many of these practices, however, did not incorporate advanced pretreatment. By carefully selecting the location and improving the design features of infiltration practices, their performance should improve.

It is absolutely critical that settleable particles and floatable organic materials be removed from runoff water before it enters the infiltration trench. The trench will clog and become nonfunctional if excessive particulate matter is allowed to enter the trench.

Cold climate considerations – see <http://www.cwp.org/cold-climates.htm>

## References

EPA, Stormwater Technology Fact Sheet - Infiltration Trench. EPA 832-F-99-019. September, 1999.

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Michigan Department of Environmental Quality. Infiltration Trench Factsheet. Available at: <http://www.deq.state.mi.us/documents/deq-swq-nps-it.pdf>

Montgomery County Department of Environmental Protection. Maintaining Urban Stormwater Facilities - A Guidebook for Common Ownership Communities. Available at: <http://www.montgomerycountymd.gov/mc/services/dep/Stormwater/maintain.htm>

Stormwater Managers Resource Center, Manual Builder. Available at: [http://www.stormwatercenter.net/intro\\_manual.htm](http://www.stormwatercenter.net/intro_manual.htm)

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U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually infiltrates into the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

## Inspection/Maintenance Considerations

Infiltration basins perform better in well-drained permeable soils. Infiltration basins in areas of low permeability can clog within a couple years, and require more frequent inspections and maintenance. The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system.

Scarification or other disturbance should only be performed when there are actual signs of clogging or significant loss of infiltrative capacity, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor. This BMP may require groundwater monitoring. Basins cannot be put into operation until the upstream tributary area is stabilized.

## Maintenance Concerns, Objectives, and Goals

- Vector Control
- Clogged soil or outlet structures
- Vegetation/Landscape Maintenance
- Groundwater contamination
- Accumulation of metals
- Aesthetics

## Targeted Constituents

- |                                     |                  |   |
|-------------------------------------|------------------|---|
| <input checked="" type="checkbox"/> | Sediment         | ■ |
| <input checked="" type="checkbox"/> | Nutrients        | ■ |
| <input checked="" type="checkbox"/> | Trash            | ■ |
| <input checked="" type="checkbox"/> | Metals           | ■ |
| <input checked="" type="checkbox"/> | Bacteria         | ■ |
| <input checked="" type="checkbox"/> | Oil and Grease   | ■ |
| <input checked="" type="checkbox"/> | Organics         | ■ |
| <input checked="" type="checkbox"/> | Oxygen Demanding | ■ |

## Legend (Removal Effectiveness)

- Low      ■ High  
▲ Medium





Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained.</li> <li>■ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition</li> </ul>	Semi-annual and after extreme events
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Factors responsible for clogging should be repaired immediately.</li> <li>■ Weed once monthly during the first two growing seasons.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Stabilize eroded banks.</li> <li>■ Repair undercut and eroded areas at inflow and outflow structures.</li> <li>■ Maintain access to the basin for regular maintenance activities.</li> <li>■ Mow as appropriate for vegetative cover species.</li> <li>■ Monitor health of vegetation and replace as necessary.</li> <li>■ Control mosquitoes as necessary.</li> <li>■ Remove litter and debris from infiltration basin area as required.</li> </ul>	Standard maintenance (as needed)
<ul style="list-style-type: none"> <li>■ Mow and remove grass clippings, litter, and debris.</li> <li>■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.</li> <li>■ Replant eroded or barren spots to prevent erosion and accumulation of sediment.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment.</li> <li>■ Seed or sod to restore ground cover.</li> <li>■ Disc or otherwise aerate bottom.</li> <li>■ Dethatch basin bottom.</li> </ul>	3-5 year maintenance



## **Additional Information**

In most cases, sediment from an infiltration basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children. Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

Light equipment, which will not compact the underlying soil, should be used to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This also prevents smearing of the basin floor.

## **References**

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: <ftp://dnr.metrokc.gov/wlr/dss/spcm/SPCM.HTM>

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.

## General Description

Retention/irrigation refers to the capture of stormwater runoff in a holding pond and subsequent use of the captured volume for irrigation of landscape or natural pervious areas. This technology is very effective as a stormwater quality practice in that, for the captured water quality volume, it provides virtually no discharge to receiving waters and high stormwater constituent removal efficiencies. This technology mimics natural undeveloped watershed conditions wherein the vast majority of the rainfall volume during smaller rainfall events is infiltrated through the soil profile. Their main advantage over other infiltration technologies is the use of an irrigation system to spread the runoff over a larger area for infiltration. This allows them to be used in areas with low permeability soils.

Capture of stormwater can be accomplished in almost any kind of runoff storage facility, ranging from dry, concrete-lined ponds to those with vegetated basins and permanent pools. The pump and wet well should be automated with a rainfall sensor to provide irrigation only during periods when required infiltration rates can be realized. Generally, a spray irrigation system is required to provide an adequate flow rate for distributing the water quality volume (LCRA, 1998). Collection of roof runoff for subsequent use (rainwater harvesting) also qualifies as a retention/irrigation practice.

## Inspection/Maintenance Considerations

Pollutant removal rates are estimated to be nearly 100% for all pollutants in the captured and irrigated stormwater volume. However, relatively frequent inspection and maintenance is necessary to verify proper operation of these facilities.

## Maintenance Concerns, Objectives, and Goals

- Sediment Accumulation
- Mechanical malfunction
- Vector Control

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	■
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

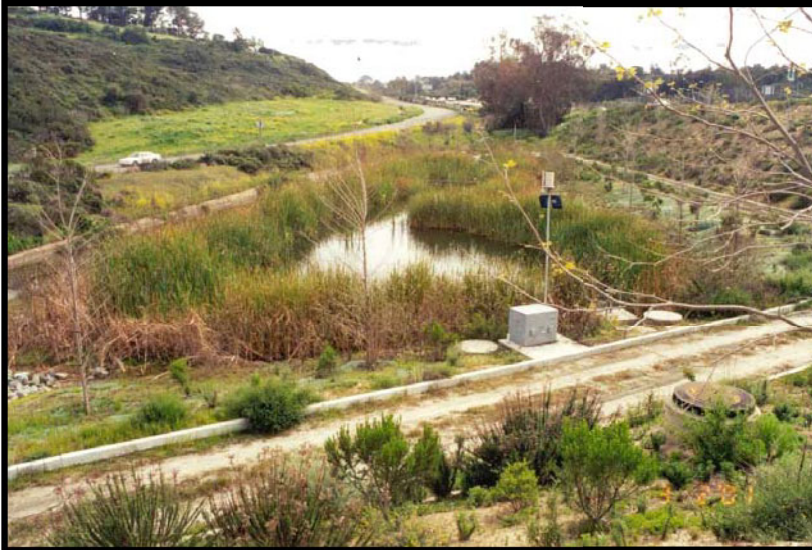
## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ The irrigation system should be inspected and tested (or observed while in operation) to verify proper operation multiple times annually. Two of these inspections should occur during or immediately following wet weather. Any leaks, broken spray heads, or other malfunctions with the irrigation system should be repaired immediately.</li> </ul>	Frequently (3-6 times per year)
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ The upper stage, side slopes, and embankment of a retention basin must be mowed regularly to discourage woody growth and control weeds.</li> </ul>	Frequently
<ul style="list-style-type: none"> <li>■ Remove sediment from inlet structure/sediment forebay, and from around the sump area at least 2 times annually or when depth reaches 3 inches. When sediment in other areas of the basin fills the volume allocated for sediment accumulation, all sediment should be removed and disposed of properly.</li> <li>■ Grass areas in and around basins must be mowed at least twice annually to limit vegetation height to 18 inches. More frequent mowing to maintain aesthetic appeal may be necessary in landscaped areas. When mowing is performed, a mulching mower should be used, or grass clippings should be caught and removed.</li> <li>■ Debris and litter will accumulate near the basin pump and should be removed during regular mowing operations and inspections. Particular attention should be paid to floating debris that can eventually clog the irrigation system.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ The pond side slopes and embankment may periodically suffer from slumping and erosion, although this should not occur often if the soils are properly compacted during construction. Regrading and revegetation may be required to correct the problems.</li> </ul>	Infrequently





## Maintenance Concerns, Objectives, and Goals

- Vegetation/Landscape Maintenance
- Endangered Species Habitat Creation
- Pollutant Removal Efficiency
- Clogging of the Outlet
- Invasive/exotic Plant Species
- Vector Control

## General Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

## Inspection/Maintenance Considerations

In order to maintain the pond's design capacity, sediment must be removed occasionally and adequate resources must be committed to properly maintain peripheral aquatic vegetation, control vector production, and to maintain effective pool volume. Wet ponds can become a nuisance due to mosquito and midge breeding unless carefully designed and maintained. A proactive and routine preventative maintenance plan (which can vary according to location) is crucial to minimizing vector habitat. A vegetated buffer should be preserved around the pond to protect the banks from erosion and provide some pollutant removal before runoff enters the pond by overland flow.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	▲
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events to confirm that the drainage system functions, and bank stability and vegetation growth are sufficient.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect for invasive vegetation, trash and debris, clogging of inlet/outlet structures, excessive erosion, sediment buildup in basin or outlet, cracking or settling of the dam, bank stability, tree growth on dam or embankment, vigor and density of the grass turf on the basin side slopes and floor, differential settlement, leakage, subsidence, damage to the emergency spillway, mechanical component condition, and graffiti.</li> </ul>	Semi-annual, after significant storms, or more frequent as needed
<ul style="list-style-type: none"> <li>■ Inspect condition of inlet and outlet structures, pipes, sediment forebays, basin, and upstream and downstream channel conditions. Monitor drain times, and check for algal growth, signs of pollution such as oil sheens, discolored water, or unpleasant odors, and signs of flooding.</li> </ul>	Annual inspection
<ul style="list-style-type: none"> <li>■ During inspections, note changes to the wet pond or the contributing watershed as these may affect basin performance.</li> </ul>	
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Introduce mosquito fish, <i>Gambusia</i> spp., (where permitted by the Department of Fish and Game or other agency regulations) to enhance natural mosquito and midge control and regularly maintain emergent and shoreline vegetation to provide access for vector inspectors and facilitate vector control if needed.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Perform vector control, if necessary.</li> <li>■ Remove sediment from outlet structure. Dispose of properly.</li> <li>■ Remove accumulated trash and debris in the basin, inlet/outlet structures, side slopes, and collection system as required.</li> <li>■ Repair undercut areas and erosion to banks and basin.</li> </ul>	Semi annual, after significant storm events
<ul style="list-style-type: none"> <li>■ Maintain protected vegetated buffer around pond. Mow side slopes and maintain vegetation in and around basin to prevent any erosion or aesthetic problems. Minimize use of fertilizers and pesticides. Reseed if necessary.</li> <li>■ Manage and harvest wetland plants.</li> <li>■ Structural repair or replacement, as needed.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Remove sediment from the forebay and regrade when the accumulated sediment volume exceeds 10-20% of the forebay volume. Clean in early spring so vegetation damaged during cleaning has time to re-establish.</li> </ul>	5- to 7-year maintenance
<ul style="list-style-type: none"> <li>■ Remove sediment when the permanent pool volume has become reduced significantly (sediment accumulation exceeds 25% of design depth), resuspension is observed, or the pond becomes eutrophic.</li> </ul>	>5 year maintenance

## Additional Information

In most cases, sediment from wet ponds do not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children.

Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

For the best water quality benefit, the pond should hold water for at least 24 hours. It should drain down to the permanent water level within 72 hours of a storm event to avoid conditions which might increase water temperatures, deplete oxygen, promote vector growth, and/or cause odors.

## References

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: <ftp://dnr.metrokc.gov/wlr/dss/spcm/SPCM.HTM>

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

Montgomery County Department of Environmental Protection. Maintaining Urban Stormwater Facilities - A Guidebook for Common Ownership Communities. Available at: <http://www.montgomerycountymd.gov/mc/services/dep/Stormwater/maintain.htm>

North Carolina Department of Environment and Natural Resources, Division of Water Quality. Maintaining Wet Detention Ponds Factsheet. Available at: [http://h2o.enr.state.nc.us/su/PDF\\_Files/Land\\_of\\_Sky\\_factsheets/FactSheet\\_7.pdf](http://h2o.enr.state.nc.us/su/PDF_Files/Land_of_Sky_factsheets/FactSheet_7.pdf)

Oregon Association of Clean Water Agencies, Oregon Municipal Stormwater Toolbox for Maintenance Practices, June 1998. Available at: <http://www.oracwa.org/Pages/toolbox.htm>

Stormwater Managers Resource Center. On-line: <http://www.stormwatercenter.net>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.





## General Description

Constructed wetlands are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from wet ponds primarily in being shallower and having greater vegetation coverage.

A distinction should be made between using a constructed wetland for storm water management and diverting storm water into a natural wetland. The latter practice is not recommended and in all circumstances, natural wetlands should be protected from the adverse effects of development, including impacts from increased storm water runoff. This is especially important because natural wetlands provide storm water and flood control benefits on a regional scale.

Wetlands are among the most effective stormwater practices in terms of pollutant removal and they also offer aesthetic value. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the wetland. Flow through the root systems forces the vegetation to remove nutrients and dissolved pollutants from the stormwater.

## Inspection/Maintenance Considerations

Wetlands need a continuous base flow to maintain aquatic plants. Salts and scum can accumulate in wetlands and, unless properly designed and managed, can be flushed out during larger storms. Wetlands can also release nutrients during the non-growing season. Wetlands can become a breeding area for mosquitoes and midges unless carefully designed and maintained. A proactive and routine preventative maintenance plan (which can vary according to location) is crucial to minimizing vector habitat.

## Maintenance Concerns, Objectives, and Goals

- Vector/Pest Control
- Sediment and Trash Removal
- Vegetation/Landscape Maintenance
- Invasive Species Management
- Bank Erosion
- Nutrient Release During Winter
- Clogging of the Outlet

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	▲
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



To maximize wetland removal of pollutants, the vegetation must be harvested frequently. Harvesting is particularly important with respect to the removal of phosphorus and metals, less so for nitrogen. Harvesting should occur by mid-summer before the plants begin to transfer phosphorus from the aboveground foliage to subsurface roots, or begin to lose metals that desorb during plant die off. While not stated by the manufacturer, it is also desirable that every few years the entire plant mass including roots be harvested. This is because the below-ground biomass constitutes a significant reservoir (possibly half) of the nutrients and metals that are removed from the stormwater by plants (Minton, 2002).

If pretreatment is provided then maintenance consideration must be given to the build up of debris and floatables.



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events for bank stability, vegetation growth, drainage system functioning, and structural damage.</li> </ul>	After construction
<ul style="list-style-type: none"> <li>■ Inspect for invasive vegetation, differential settlement, cracking; erosion, leakage, or tree growth on the embankment; the condition of the riprap in the inlet, outlet, and pilot channels; sediment accumulation in the basin; clogging of outlet; and the vigor and density of the vegetation on the basin side slopes and floor. Correct observed problems as necessary.</li> </ul>	Semi-annual inspection
<ul style="list-style-type: none"> <li>■ Inspect for damage to the embankment and inlet/outlet structures. Repair as necessary.</li> <li>■ Note signs of hydrocarbon buildup such as floating oil on water surface.</li> <li>■ Monitor for sediment accumulation in the facility and forebay.</li> <li>■ Examine inlet and outlet devices to ensure they are free of debris and are operational.</li> </ul>	Annual inspection
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Replace wetland vegetation to maintain at least 50% surface area coverage in wetland plants after the second growing season.</li> </ul>	One-time
<ul style="list-style-type: none"> <li>■ Repair undercut areas, erosion to banks, and bottom as required.</li> <li>■ Where permitted by the Department of Fish and Game or other agency regulations, stock constructed wetlands regularly with mosquito fish (<i>Gambusia</i> spp.) to enhance natural mosquito and midge control</li> </ul>	As needed maintenance
<ul style="list-style-type: none"> <li>■ Clean and remove debris from inlet and outlet structures.</li> <li>■ Mow side slopes and remove grass clippings.</li> <li>■ Remove litter and debris from banks, basin bottom, trash racks, outlet structures, and valves as required.</li> </ul>	Frequent (3-4 times/year) maintenance
<ul style="list-style-type: none"> <li>■ Supplement wetland plants if a significant portion have not established (at least 50% of the surface area).</li> <li>■ Remove nuisance plant species.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Clean forebay to avoid accumulation in main wetland area to minimize when the main wetland area needs to be cleaned.</li> </ul>	5- to 7-year maintenance
<ul style="list-style-type: none"> <li>■ Harvest plant species if vegetation becomes too thick causing flow backup and flooding. More frequent plant harvesting may be required by local vector control agencies.</li> </ul>	5- to 7-year maintenance (or more frequently as required)
<ul style="list-style-type: none"> <li>■ Monitor sediment accumulations, and remove sediment when the accumulated sediment volume exceeds 10-20% of the basin volume, plants are “choked” with sediment, or the wetland becomes eutrophic. It is suggested that the main area be cleaned one half at a time with at least one growing season in between cleanings. This will help to preserve the vegetation and enable the wetland to recover more quickly from the cleaning.</li> </ul>	As needed maintenance (20- to 50-years)

## Additional Information

The following observations should be made during the inspections:

- Type and distribution of dominant wetland plants in the marsh
- The presence and distribution of planted wetland species
- The presence and distribution of invasive wetland species
- Signs that invasive species are replacing the planted wetland species
- Percentage of unvegetated standing water (excluding the deep water cells which are not suitable for emergent plant growth)
- The maximum elevation and the vegetative condition in this zone, if the design elevation of the normal pool is being maintained for wetlands with extended zones
- Stability of the original depth zones and the microtopographic features, accumulation of sediment in the forebay and micropool, and survival rate of plants in the wetland buffer.

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

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## Maintenance Concerns, Objectives, and Goals

- Vector/Pest Control
- Sediment and Trash Removal
- Vegetation/Landscape Maintenance
- Re-suspension of settled material
- Clogging of the Outlet

## General Description

Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the stormwater runoff from a water quality design storm for some minimum time (e.g., 72 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. They can also be used to provide flood control by including additional flood detention storage.

## Inspection/Maintenance Considerations

Inspections should be conducted semi-annually and after significant storm events to identify potential problems early. Most maintenance efforts will need to be directed toward vegetation management and vector control, which may focus on basic housekeeping practices such as removal of debris accumulations and vegetation management to ensure that the basin dewateres completely (recommended 72 hour residence time or less) to prevent creating mosquito and other vector habitats.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	▲
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	▲
<input checked="" type="checkbox"/>	Bacteria	▲
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	▲
<input checked="" type="checkbox"/>	Oxygen Demanding	▲

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events for bank stability, vegetation growth, and to determine if the desired residence time has been achieved.</li> <li>■ Inspect outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect for the following issues: differential settlement, cracking; erosion of pond banks or bottom, leakage, or tree growth on the embankment; the condition of the riprap in the inlet, clogging of outlet and pilot channels; standing water, slope stability, presence of burrows; sediment accumulation in the basin, forebay, and outlet structures; trash and debris, and the vigor and density of the grass turf on the basin side slopes and floor.</li> </ul>	Semi-annual, after significant storms, or more frequent
<ul style="list-style-type: none"> <li>■ Inspect for the following issues: subsidence, damage to the emergency spillway; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel, accumulated sediment volume, and semi-annual inspection items.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ During inspections, changes to the extended storage pond or the contributing watershed should be noted, as these may affect basin performance.</li> </ul>	Annual inspection
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ If necessary, modify the outlet orifice to achieve design values if inspection indicates modifications are necessary.</li> <li>■ Repair undercut or eroded areas.</li> <li>■ Mow side slopes.</li> <li>■ Manage pesticide and nutrients.</li> <li>■ Remove litter and debris.</li> <li>■ Control vectors as necessary.</li> </ul>	As needed
<ul style="list-style-type: none"> <li>■ Remove accumulated trash and debris from the basin, around the riser pipe, side slopes, embankment, emergency spillway, and outflow trash racks. The frequency of this activity may be altered to meet specific site conditions.</li> <li>■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.</li> </ul>	Semi-annual, or more frequent, as needed
<ul style="list-style-type: none"> <li>■ Seed or sod to restore dead or damaged ground cover.</li> <li>■ Repair erosion to banks and bottom as required.</li> </ul>	Annual maintenance (as needed)
<ul style="list-style-type: none"> <li>■ Supplement wetland plants if a significant portion have not been established (at least 50% of the surface area).</li> <li>■ Remove nuisance plant species.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Remove sediment from the forebay to reduce frequency of main basin cleaning.</li> </ul>	3- to 5-year maintenance
<ul style="list-style-type: none"> <li>■ Monitor sediment accumulation and remove accumulated sediment and regrade about every 10 years or when the accumulated sediment volume exceeds 10-20% of the basin volume, or when accumulation reaches 6 inches or if resuspension is observed. Clean in early spring so vegetation damaged during cleaning has time to re-establish.</li> </ul>	Every 10-25 years



## **Additional Information**

In most cases, sediment from extended detention basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are likely to meet toxicity limits and can be safely landfilled or disposed of onsite. Onsite sediment disposal is always preferable (if local authorities permit it) as long as the sediments are deposited away from the shoreline to prevent their re-entry into the pond.

Sediments should be tested for toxin in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed.

## **References**

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## Maintenance Concerns, Objectives, and Goals

- Channelization
- Vegetation/Landscape Maintenance
- Vector Control
- Aesthetics
- Hydraulic and Removal Efficacy

## General Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for residential, industrial, and commercial areas with low flow and smaller populations.

## Inspection/Maintenance Considerations

It is important to consider that a thick vegetative cover is needed for vegetated swales to function properly. Usually, swales require little more than normal landscape maintenance activities such as irrigation and mowing to maintain pollutant removal efficiency. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g., debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained. The application of fertilizers and pesticides should be minimized.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	▲
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	●
<input checked="" type="checkbox"/>	Metals	▲
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	▲
<input checked="" type="checkbox"/>	Oxygen Demanding	▲

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
■ Inspect after seeding and after first major storms for any damages.	Post construction
■ Inspect for signs of erosion, damage to vegetation, channelization of flow, debris and litter, and areas of sediment accumulation. Perform inspections at the beginning and end of the wet season. Additional inspections after periods of heavy runoff are desirable.	Semi-annual
■ Inspect level spreader for clogging, grass along side slopes for erosion and formation of rills or gullies, and sand/soil bed for erosion problems.	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Mow grass to maintain a height of 3–4 inches, for safety, aesthetic, or other purposes. Litter should always be removed prior to mowing. Clippings should be composted.</li> <li>■ Irrigate swale during dry season (April through October) or when necessary to maintain the vegetation.</li> <li>■ Provide weed control, if necessary to control invasive species.</li> </ul>	As needed (frequent, seasonally)
<ul style="list-style-type: none"> <li>■ Remove litter, branches, rocks blockages, and other debris and dispose of properly.</li> <li>■ Maintain inlet flow spreader (if applicable).</li> <li>■ Repair any damaged areas within a channel identified during inspections. Erosion rills or gullies should be corrected as needed. Bare areas should be replanted as necessary.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Declog the pea gravel diaphragm, if necessary.</li> <li>■ Correct erosion problems in the sand/soil bed of dry swales.</li> <li>■ Plant an alternative grass species if the original grass cover has not been successfully established. Reseed and apply mulch to damaged areas.</li> </ul>	Annual (as needed)
<ul style="list-style-type: none"> <li>■ Remove all accumulated sediment that may obstruct flow through the swale. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation, or once it has accumulated to 10% of the original design volume. Replace the grass areas damaged in the process.</li> <li>■ Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.</li> </ul>	As needed (infrequent)

## **Additional Information**

Recent research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

## **References**

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.





## Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species Management
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

## General Description

Grassed buffer strips (vegetated filter strips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal. In addition, the public views them as landscaped amenities and not as stormwater infrastructure. Consequently, there is little resistance to their use.

## Inspection/Maintenance Considerations

Vegetated buffer strips require frequent landscape maintenance. In many cases, vegetated buffer strips initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor. Maintenance requirements typically include grass or shrub-growing activities such as irrigation, mowing, trimming, removal of invasive species, and replanting when necessary. Buffer strips require more tending as the volume of sediment increases. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless designed to dewater completely in 72 hours or less) and/or if proper drainage slopes are not maintained.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	▲
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	▲
<input checked="" type="checkbox"/>	Oxygen Demanding	▲

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Once the vegetated buffer strip is established, inspect at least three times per year. Repair all damage immediately.</li> <li>■ Inspect buffer strips after seeding and repair as needed.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect buffer strip and repair all damage immediately.</li> <li>■ Inspect soil and repair eroded areas.</li> </ul>	After major storms
<ul style="list-style-type: none"> <li>■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.</li> <li>■ Inspect pea-gravel diaphragm/level spreader for clogging and effectiveness and remove built-up sediment.</li> <li>■ Inspect for rolls and gullies. Immediately fill with topsoil, install erosion control blanket and seed or sod.</li> <li>■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.</li> <li>■ Check for debris and litter, and areas of sediment accumulation.</li> </ul>	Semi-annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Water plants daily for 2 weeks after construction.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Mow regularly to maintain vegetation height between 2 - 4 inches, and to promote thick, dense vegetative growth. Cut only when soil is dry to prevent tracking damage to vegetation, soil compaction and flow concentrations. Clippings are to be removed immediately after mowing.</li> <li>■ Remove all litter, branches, rocks, or other debris. Damaged areas of the filter strip should be repaired immediately by reseeding and applying mulch.</li> <li>■ Regularly maintain inlet flow spreader.</li> <li>■ Irrigate during dry season (April through October) when necessary to maintain the vegetation.</li> </ul>	Frequently, as needed
<ul style="list-style-type: none"> <li>■ Remulch void areas.</li> <li>■ Treat diseased trees and shrubs, remove dead vegetation.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Remove sediment and replant in areas of buildup. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation.</li> <li>■ Limit fertilizer applications based on plant vigor and soil test results.</li> <li>■ Rework or replant buffer strip if concentrated flow erodes a channel through the strip.</li> </ul>	Annual

## **Additional Information**

Recent research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

## **References**

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.





## Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

## General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

## Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	▲
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect soil and repair eroded areas.</li> </ul>	Monthly
<ul style="list-style-type: none"> <li>■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.</li> </ul>	Semi-annual inspection
<ul style="list-style-type: none"> <li>■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.</li> </ul>	
<ul style="list-style-type: none"> <li>■ Check for debris and litter, and areas of sediment accumulation.</li> </ul>	
<ul style="list-style-type: none"> <li>■ Inspect health of trees and shrubs.</li> </ul>	
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Water plants daily for 2 weeks.</li> </ul>	At project completion
<ul style="list-style-type: none"> <li>■ Remove litter and debris.</li> </ul>	Monthly
<ul style="list-style-type: none"> <li>■ Remove sediment.</li> <li>■ Remulch void areas.</li> <li>■ Treat diseased trees and shrubs.</li> <li>■ Mow turf areas.</li> <li>■ Repair erosion at inflow points.</li> <li>■ Repair outflow structures.</li> <li>■ Unclog underdrain.</li> <li>■ Regulate soil pH regulation.</li> </ul>	As needed
<ul style="list-style-type: none"> <li>■ Remove and replace dead and diseased vegetation.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Add mulch.</li> <li>■ Replace tree stakes and wires.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.</li> </ul>	Every 2-3 years, or as needed

## Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at:  
[cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## Maintenance Concerns, Objectives, and Goals

- Pollutant Breakthrough
- Clogged of Sand Media
- Trash and Debris Accumulation

## General Description

Stormwater media filters are usually two-chambered including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber. There are a number of design variations including the Austin sand filter, Delaware sand filter, and multi-chambered treatment train (MCTT).

## Inspection/Maintenance Considerations

Media filters may exhibit decreased effectiveness after a few years of operation, depending on the activities occurring in the drainage area. Media filters clog easily when subjected to high sediment loads. Sediment reducing pretreatment practices, such as vegetated buffer strips or vegetated swales, placed upstream of the filter should be maintained properly to reduce sediment loads into filter. Media filters can become a nuisance due to mosquito or midge breeding if not properly designed and maintained. Installations should dewater completely (recommended 72 hour or less residence time) to prevent creating mosquito and other vector habitats. Maintenance efforts will need to focus on basic housekeeping practices such as removal of debris accumulations and vegetation management (in filter media) to prevent clogs and/or pods of standing water. To minimize the potential for clogging, frequent maintenance and inspection practices are required. Waste sand, gravel, filter cloth, or filter media must be disposed of properly and in accordance with all applicable laws.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	▲
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ During the first year of operation, inspect chambers quarterly to ensure that the system is functioning properly.</li> <li>■ Inspect sand filters after every major storm in the first few months after construction to ensure that the system is functioning properly.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Ensure that filter surface, inlets, and outlets are clear of debris.</li> <li>■ Ensure that the contributing area is stabilized and mowed, with clippings removed.</li> <li>■ Check to ensure that the filter surface is not clogging.</li> <li>■ Ensure that activities in the drainage area minimize oil/grease and sediment entry to the system.</li> <li>■ Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.</li> </ul>	Quarterly, and after major storms
<ul style="list-style-type: none"> <li>■ Inspect for standing water, sediment, trash and debris, structural damage, and to identify potential problems.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Check to see that the filter bed is clean of sediments and the sediment chamber contains no more than six inches of sediment.</li> <li>■ Make sure that there is no evidence of deterioration of concrete structures.</li> <li>■ Inspect grates (if used).</li> <li>■ Inspect inlets, outlets, and overflow spillway to ensure good condition and no evidence of erosion.</li> <li>■ Ensure that flow is not bypassing the facility.</li> <li>■ Ensure that no noticeable odors are detected outside the facility.</li> </ul>	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Remove trash and debris from the sedimentation basin (Austin design), the riser pipe, and the filter bed as needed.</li> <li>■ Prevent grass clippings from washing into the filter.</li> <li>■ Remove trash from inlet grates to maintain the inflow capacity of the media filter.</li> <li>■ Upstream vegetation should be maintained as needed.</li> </ul>	Frequently (as needed)
<ul style="list-style-type: none"> <li>■ Clean filter surface semiannually; or more often if watershed is excessively erosive.</li> <li>■ Replace sorbent pillows (Multi-Chamber Treatment Train only).</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Repair or replace any damaged structural parts.</li> <li>■ Stabilize any eroded areas.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ Remove accumulated sediment in the sedimentation chamber every 10 years or when the sediment occupies 10-20% of the basin volume or accumulates to a depth of six inches, whichever is less.</li> <li>■ Remove top 2 in. of media filter and landfill if facility drain time exceeds 72 hr. Restore media depth to 18 in. when overall media depth drops to 12 in.).</li> </ul>	As needed



## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at:  
<http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at:  
[http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.

## General Description

Water quality inlets (WQIs), also commonly called trapping catch basins, oil/grit separators or oil/water separators, consist of one or more chambers that promote sedimentation of coarse materials and separation of free oil (as opposed to emulsified or dissolved oil) from stormwater. Some WQIs also contain screens to help retain larger or floating debris, and many of the newer designs also include a coalescing unit that helps promote oil/water separation.

These devices are appropriate for capturing hydrocarbon spills, but provide very marginal sediment removal and are not very effective for treatment of stormwater runoff. WQIs typically capture only the first portion of runoff for treatment and are generally used for pretreatment before discharging to other best management practices (BMPs).

## Inspection/Maintenance Considerations

High sediment loads can interfere with the ability of the WQI to effectively separate oil and grease from the runoff. During periods of high flow, sediment can be resuspended and released from the WQI into surface waters. Maintenance of WQIs can be easily neglected because they are underground. Establishment of a maintenance schedule is helpful for ensuring proper maintenance occurs. The required maintenance effort will be site-specific due to variations in sediment and hydrocarbon loading. Since WQI residuals contain hydrocarbon by-products, they may require disposal as hazardous waste. Many WQI owners coordinate with waste haulers to collect and dispose of these residuals.

## Maintenance Concerns, Objectives, and Goals

- High Sediment Loads
- Hazardous Waste
- Vector Control

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	●
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	▲
<input checked="" type="checkbox"/>	Metals	●
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	●
<input checked="" type="checkbox"/>	Oxygen Demanding	●

### Legend (Removal Effectiveness)

- Low      ■ High  
▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after every storm event to determine if maintenance is required.</li> </ul>	Monthly during the wet season, or after significant rain events
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Clean out and dispose of accumulated oil, grease, and sediments. Remove accumulated trash and debris. The clean out and disposal techniques should be environmentally acceptable and in accordance with local regulations.</li> </ul>	Annual, before the wet season, or more frequent as needed

## Additional Information

Since WQIs can be relatively deep, they may be designated as confined spaces. Caution should be exercised to comply with confined space entry safety regulations if it is required.

## References

<http://www.co.pierce.wa.us/pc/services/home/envIRON/water/swm/sppman/bmpt1.htm>

## General Description

A multiple treatment system uses two or more BMPs in series. Some examples of multiple systems include: settling basin combined with a sand filter; settling basin or biofilter combined with an infiltration basin or trench; extended detention zone on a wet pond.

## Inspection/Maintenance Considerations

Each of the separate treatment processes will require maintenance as described in the previous fact sheets. For example, multiple system comprises of a biofilter combined with an infiltration basin would require the inspection and maintenance considerations outlined on the fact sheet for each process.

Inspection Activities	Suggested Frequency
■ Refer to individual treatment control factsheets	As needed
Maintenance Activities	Suggested Frequency
■ Refer to individual treatment control factsheets	As needed

## Maintenance Concerns, Objectives, and Goals

May include the following:

- Accumulation of Metals
- Aesthetics
- Channelization of Flow
- Clogging of the Outlet
- Endangered Species Habitat Creation
- Erosion
- Groundwater Contamination
- Hazardous Waste
- Hydraulic and Removal Efficiency
- Invasive Species Management
- Mechanical Malfunction
- Pollutant Breakthrough
- Re-suspension of settled material
- Sediment and Trash Removal
- Sedimentation
- Vector/Pest Control
- Vegetation harvesting
- Vegetation/Landscape Maintenance

## Targeted Constituents

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Sediment         | ■ |
| <input checked="" type="checkbox"/> Nutrients        | ● |
| <input checked="" type="checkbox"/> Trash            | ■ |
| <input checked="" type="checkbox"/> Metals           | ■ |
| <input checked="" type="checkbox"/> Bacteria         | ▲ |
| <input checked="" type="checkbox"/> Oil and Grease   | ■ |
| <input checked="" type="checkbox"/> Organics         | ■ |
| <input checked="" type="checkbox"/> Oxygen Demanding | ■ |

Legend (Removal Effectiveness)

- Low      ■ High  
▲ Medium





## General Description

A manufactured wetland is similar to public domain stormwater wetlands. In a manufactured wetland, gravel substrate and subsurface flow of the stormwater through the root systems force the vegetation to remove nutrients and dissolved pollutants from the stormwater.

Only one company currently manufactures a pre-engineered wetland: It consists of a standard module, about 9.5 feet in diameter and 4 feet in height. The module is constructed of recycled polyethylene. The number of units is varied to meet the design volume of the site.

## Inspection/Maintenance Considerations

To maximize wetland removal of pollutants, the vegetation must be harvested frequently. Harvesting is particularly important with respect to the removal of phosphorus and metals, less so nitrogen. Harvesting should occur by mid-summer before the plants begin to transfer phosphorus from the aboveground foliage to subsurface roots, or begin to lose metals that desorb during plant die off. While not stated by the manufacturer, it is also desirable that every few years the entire plant mass including roots be harvested. This is because the belowground biomass constitutes a significant reservoir (possibly half) of the nutrients and metals that are removed from the stormwater by plants (Minton, 2002).

If pretreatment is provided then maintenance consideration must be given to the build up of debris and floatables.

Inspection Activities	Suggested Frequency
■ Inspect during the dry season to determine if irrigation of plants is necessary.	As needed
■ Inspect to verify that invasive species of wetland plants is not occurring.	Annual
Maintenance Activities	Suggested Frequency
■ Clean the center well.	As needed
■ Remove vegetation near end of each growth season to capture the nutrients and pollutants removed by the wetland vegetation.	Annual

## Maintenance Concerns, Objectives, and Goals

- Vegetation/Landscape Maintenance
- Endangered Species Habitat Creation
- Pollutant Removal Efficiency
- Clogging of the Outlet
- Invasive/exotic Plant Species
- Vector Control

## Targeted Constituents

- ☒ Sediment
- ☒ Nutrients
- ☒ Trash
- ☒ Metals
- ☒ Bacteria
- ☒ Oil and Grease
- ☒ Organics
- ☒ Oxygen Demanding

### Removal Effectiveness

See New Development and Redevelopment BMP Handbook-Section 5.



## General Description

Stormwater media filters are usually two-chambered including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber.

There are currently three manufacturers of stormwater filter systems. Two are similar in that they use cartridges of a standard size. The cartridges are placed in vaults; the number of cartridges a function of the design flow rate. The water flows laterally (horizontally) into the cartridge to a centerwell, then downward to an underdrain system. The third product is a flatbed filter, similar in appearance to sand filters.

## Inspection/Maintenance Considerations

Media filters may exhibit decreased effectiveness after a few years of operation, depending on the activities occurring in the drainage area. Media filters clog easily when subjected to high sediment loads. Sediment reducing pretreatment practices, such as vegetated buffer strips or vegetated swales, placed upstream of the filter should be maintained properly to reduce sediment loads into filter. Media filters can become a nuisance due to mosquito or midge breeding if not properly designed and maintained. Installations should dewater completely (recommended 72 hour or less residence time) to prevent creating mosquito and other vector habitats. Maintenance efforts will need to focus on basic housekeeping practices such as removal of debris accumulations and vegetation management (in filter media) to prevent clogs and/or pods of standing water. To minimize the potential for clogging, frequent maintenance and inspection practices are required. Waste sand, gravel, filter cloth, or filter media must be disposed of properly and in accordance with all applicable laws.

## Maintenance Concerns, Objectives, and Goals

- Pollutant Breakthrough
- Clogged of Sand Media
- Trash and Debris Accumulation

## Targeted Constituents

- ☒ Sediment
- ☒ Nutrients
- ☒ Trash
- ☒ Metals
- ☒ Bacteria
- ☒ Oil and Grease
- ☒ Organics
- ☒ Oxygen Demanding

### Removal Effectiveness

See New Development and Redevelopment BMP Handbook- Section 5.



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ During the first year of operation, inspect chambers quarterly to ensure that the system is functioning properly.</li> <li>■ Inspect sand filters after every major storm in the first few months after construction to ensure that the system is functioning properly.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Ensure that filter surface, inlets, and outlets are clear of debris.</li> <li>■ Ensure that the contributing area is stabilized and mowed, with clippings removed.</li> <li>■ Check to ensure that the filter surface is not clogging.</li> <li>■ Ensure that activities in the drainage area minimize oil/grease and sediment entry to the system.</li> <li>■ Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.</li> </ul>	Quarterly, and after major storms
<ul style="list-style-type: none"> <li>■ Inspect for standing water, sediment, trash and debris, structural damage, and to identify potential problems.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Check to see that the filter bed is clean of sediments and the sediment chamber contains no more than six inches of sediment.</li> <li>■ Make sure that there is no evidence of deterioration of concrete structures.</li> <li>■ Inspect grates (if used).</li> <li>■ Inspect inlets, outlets, and overflow spillway to ensure good condition and no evidence of erosion.</li> <li>■ Ensure that flow is not bypassing the facility.</li> <li>■ Ensure that no noticeable odors are detected outside the facility.</li> </ul>	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Remove trash and debris from the sedimentation basin (Austin design), the riser pipe, and the filter bed as needed.</li> <li>■ Prevent grass clippings from washing into the filter.</li> <li>■ Remove trash from inlet grates to maintain the inflow capacity of the media filter.</li> <li>■ Upstream vegetation should be maintained as needed.</li> </ul>	Frequently (as needed)
<ul style="list-style-type: none"> <li>■ Clean filter surface semiannually; or more often if watershed is excessively erosive.</li> <li>■ Replace sorbent pillows (Multi-Chamber Treatment Train only).</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Repair or replace any damaged structural parts.</li> <li>■ Stabilize any eroded areas.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ Remove accumulated sediment in the sedimentation chamber every 10 years or when the sediment occupies 10-20% of the basin volume or accumulates to a depth of six inches, whichever is less.</li> <li>■ Remove top 2 in. of media filter and landfill if facility drain time exceeds 72 hr. Restore media depth to 18 in. when overall media depth drops to 12 in.).</li> </ul>	As needed

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at:  
<http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at:  
[http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## General Description

A wet vault is a vault with a permanent water pool, generally 3 to 5 feet deep. The vault may also have a constricted outlet that causes a temporary rise of the water level (i.e., extended detention) during each storm. This live volume generally drains within 12 to 48 hours after the end of each storm.

## Inspection/Maintenance Considerations

Maintenance of wet vaults requires special equipment. Each manufacturer provides storage capacities with respect to sediments and floatables, with recommendations on the frequency of cleaning as a function of the percentage of the volume in the unit that has been filled by these materials. There is concern about mosquito breeding in standing water. A loss of dissolved pollutants may occur as accumulated organic matter (e.g., leaves) decomposes in the units. If regular maintenance is not performed, accumulated sediment may cause noxious gases to form.

It is important to recognize that as storage of accumulated sediment occurs directly in the operating area of the wet vault, treatment efficiency will decline over time given the reduction in treatment volume. Whether this is significant depends on the design capacity. Some manufactured wet vaults have relatively little sediment storage and therefore must be cleaned frequently (e.g., annually) while others have sufficient capacity to reduce cleaning frequency. Vault maintenance procedures must meet OSHA confined space entry requirements.

Sediment should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed.

## Maintenance Concerns, Objectives, and Goals

- Sediment Removal
- Vector Control

## Targeted Constituents

- ☒ Sediment
- ☒ Nutrients
- ☒ Trash
- ☒ Metals
- ☒ Bacteria
- ☒ Oil and Grease
- ☒ Organics
- ☒ Oxygen Demanding

### Removal Effectiveness

See New Development and Redevelopment BMP Handbook-Section 5.



Inspection Activities	Suggested Frequency
■ Inspect the unit twice during the first wet season of operation, setting the cleaning frequency accordingly.	Post construction
■ Inspect for floating debris, sediment buildup, and accumulated petroleum products.	Annual
Maintenance Activities	Suggested Frequency
■ Remove sediment that has accumulated in the vault after construction in the drainage area is complete.	Post construction
■ The recommended frequency of cleaning differs with the manufacturer, ranging from one to two years.	Annual, or per manufacturers recommendations
■ Maintenance consists of the removal of accumulated material with an eductor truck. It may be necessary to remove and dispose the floatables separately due to the presence of petroleum product. Annual maintenance is typical.	
■ Remove floating debris and accumulated petroleum products as needed. Floating oil should be removed from wet vaults that are used as oil/water separators when oil accumulation exceeds one inch.	Annual, or more frequent as needed

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

## General Description

Vortex separators: (alternatively, swirl concentrators) are gravity separators, and in principle are essentially wet vaults. The difference from wet vaults, however, is that the vortex separator is round, rather than rectangular, and the water moves in a centrifugal fashion before exiting. By having the water move in a circular fashion, rather than a straight line as is the case with a standard wet vault, it is possible to obtain significant removal of suspended sediments and attached pollutants with less space. Vortex separators were originally developed for combined sewer overflows (CSOs), where it is used primarily to remove coarse inorganic solids. Vortex separation has been adapted to stormwater treatment by several manufacturers.

## Inspection/Maintenance Considerations

As some of the systems have standing water that remains between storms, there is concern about mosquito breeding. Also, a loss of dissolved pollutants may occur as accumulated organic matter (e.g., leaves) decomposes in the units.

Inspection Activities	Suggested Frequency
■ Inspect for accumulated sediment/debris.	As needed
Maintenance Activities	Suggested Frequency
■ Remove of accumulated material with an eductor truck. It may be necessary to remove and dispose the floatables separately due to the presence of petroleum product.	Annual, or more frequent as needed

## Maintenance Concerns, Objectives, and Goals

- Sediment/Debris Removal
- Vector Control

## Targeted Constituents

- ☒ Sediment
- ☒ Nutrients
- ☒ Trash
- ☒ Metals
- Bacteria
- ☒ Oil and Grease
- ☒ Organics
- ☒ Oxygen Demanding

## Removal Effectiveness

See New Development and Redevelopment BMP Handbook-Section 5.



## General Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

## Inspection/Maintenance Considerations

Washout problems increase with rain intensity. At low flow rates, energy dissipater between gate and treatment areas can minimize re-suspension of accumulated sediment.

Inspection Activities		Suggested Frequency
■ Inspect for sediment buildup and proper functioning.		At the beginning of the wet season and after significant storms
■ Verify that stormwater enters the unit and does not leak around the perimeter.		After construction.
Maintenance Activities		Suggested Frequency
■ Remove sediment as needed.		At the beginning of the wet season and as necessary

## Maintenance Concerns, Objectives, and Goals

- Sediment/Debris Removal

## Targeted Constituents

- ☒ Sediment
- ☒ Nutrients
- ☒ Trash
- ☒ Metals
- Bacteria
- ☒ Oil and Grease
- ☒ Organics
- ☒ Oxygen Demanding

### Removal Effectiveness

See New Development and Redevelopment BMP Handbook-Section 5.





# Section 4

## Treatment Control BMPs

### 4.1 Introduction

This section discusses the inspection and maintenance requirements for treatment control BMPs shown in Table 4-1. The specific design requirements, performance specifications, and limitations of each of these BMPs are discussed in detail in the New Development and Redevelopment BMP Handbook. Inspection and maintenance requirements are necessary to verify that each treatment control BMP performs efficiently throughout its design life. Although specific inspection and maintenance frequencies are presented in the following fact sheets, these are only suggested and should be adapted to each site situation to best accommodate environmental, economic, and local regulatory concerns.

For the purpose of this Handbook, treatment control BMPs have been classified according to whether they are public domain or proprietary controls. Public domain controls, as the name implies, are controls that are available to the general public, while proprietary controls are typically patented devices and are purchased from a vendor.

### 4.2 Fact Sheet Format

A BMP fact sheet is a short document that gives pertinent maintenance and inspection information about a particular treatment control BMP. Typically, each fact sheet contains the information outlined in Figure 4-1. Completed fact sheets for each of the treatment control BMPs shown in Table 4-1 are provided in Section 4.3.

The fact sheets also contain side bar presentations with information on BMP maintenance concerns, objectives, and goals; targeted constituents; and removal effectiveness if known.

Table 4-1 Treatment Control BMPs	
Public Domain	
TC-10	Infiltration Trench
TC-11	Infiltration Basin
TC-12	Retention/Irrigation
TC-20	Wet Pond
TC-21	Constructed Wetland
TC-22	Extended Detention Basin
TC-30	Vegetated Swale
TC-31	Vegetated Buffer Strip
TC-32	Bioretention
TC-40	Media Filter
TC-50	Water Quality Inlet
TC-60	Multiple Systems
Manufactured (Proprietary)	
MP-20	Wetland
MP-40	Media Filter
MP-50	Wet Vault
MP-51	Vortex Separator
MP-52	Drain Inlet

#### TC-xx Example Maintenance Fact Sheet

General Description  
Inspection/Maintenance Considerations  
Inspection Activities  
Maintenance Activities  
Additional Information  
References

**Figure 4-1**  
**Example Fact Sheet**

## 4.3 BMP Fact Sheets

Maintenance BMP fact sheets for public domain and manufactured BMPs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusion in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at [www.cabmphandbooks.com](http://www.cabmphandbooks.com). As noted previously, the reader should refer to the New Development and Redevelopment BMP Handbook for details regarding BMP design, performance, and installation. In addition to the references at the end of each fact sheet, the 1993 version of the California Stormwater BMP Handbook was used as a general reference and starting point for the preparation of the maintenance fact sheets that follow.

In addition, it is worth noting that there are numerous proprietary treatment control devices available. Manufacturers typically have recommended inspection schedules and maintenance requirements for each device. If your facility utilizes proprietary treatment control devices for stormwater runoff, a maintenance agreement and detailed maintenance plan should be developed to ensure that they are well maintained, and operate according to design specifications. For many manufactured devices, municipalities can contract with the manufacturer or representative to provide maintenance services.



## Maintenance Concerns, Objectives, and Goals

- Accumulation of Metals
- Clogged Soil Outlet Structures
- Vegetation/Landscape Maintenance

## General Description

An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix. Infiltration trenches perform well for removal of fine sediment and associated pollutants. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of coarse sediment entering the trench which can clog and render the trench ineffective.

## Inspection/Maintenance Considerations

Frequency of clogging is dependant on effectiveness of pretreatment, such as vegetated buffer strips, at removing sediments. See appropriate maintenance factsheets for associated pretreatment. If the trench clogs, it may be necessary to remove and replace all or part of the filter fabric and possibly the coarse aggregate. Clogged infiltration trenches with surface standing water can become a nuisance due to mosquito breeding. Maintenance efforts associated with infiltration trenches should include frequent inspections to ensure that water infiltrates into the subsurface completely at a recommended infiltration rate of 72 hours or less to prevent creating mosquito and other vector habitats. Most of the maintenance should be concentrated on the pretreatment practices, such as buffer strips and swales upstream of the trench to ensure that sediment does not reach the infiltration trench. Regular inspection should determine if the sediment removal structures require routine maintenance. Infiltration trenches should not be put into operation until the upstream tributary area is stabilized.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	■
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after every major storm for the first few months to ensure proper functioning. Drain times should be observed to confirm that designed drain times has been achieved.</li> </ul>	After construction
<ul style="list-style-type: none"> <li>■ Inspect facility for signs of wetness or damage to structures, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, standing water, and material buildup.</li> <li>■ Check for standing water or, if available, check observation wells following 3 days of dry weather to ensure proper drain time.</li> <li>■ Inspect pretreatment devices and diversion structures for damage, sediment buildup, and structural damage.</li> </ul>	Semi-annual and after extreme events
<ul style="list-style-type: none"> <li>■ Trenches with filter fabric should be inspected for sediment deposits by removing a small section of the top layer. If inspection indicates that the trench is partially or completely clogged, it should be restored to its design condition.</li> </ul>	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Repair undercut and eroded areas at inflow and outflow structures.</li> <li>■ Remove sediment, debris, and oil/grease from pretreatment devices and overflow structures.</li> </ul>	Standard maintenance (as needed)
<ul style="list-style-type: none"> <li>■ Remove trash, debris, grass clippings, trees, and other large vegetation from the trench perimeter and dispose of properly.</li> <li>■ Mow and trim vegetation to prevent establishment of woody vegetation, and for aesthetic and vector reasons.</li> </ul>	Semi-annual, more often as needed
<ul style="list-style-type: none"> <li>■ Clean out sediment traps, forebays, inlet/outlet structures, overflow spillway, and trenches if necessary.</li> <li>■ Remove grass clippings, leaves, and accumulated sediment from the surface of the trench. Replace first layer of aggregate and filter fabric if clogging appears only to be at the surface.</li> <li>■ Clean trench when loss of infiltrative capacity is observed. If drawdown time is observed to have increased significantly over the design drawdown time, removal of sediment may be necessary. This is an expensive maintenance activity and the need for it can be minimized through prevention of upstream erosion.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ If bypass capability is available, it may be possible to regain the infiltration rate in the short term by providing an extended dry period.</li> <li>■ Seed or sod to restore ground cover.</li> </ul>	5-year maintenance
<ul style="list-style-type: none"> <li>■ Total rehabilitation of the trench should be conducted to maintain storage capacity within 2/3 of the design treatment volume and 72-hour exfiltration rate limit.</li> <li>■ Trench walls should be excavated to expose clean soil.</li> <li>■ All of the stone aggregate and filter fabric or media must be removed. Accumulated sediment should be stripped from the trench bottom. At this point the bottom may be scarified or tilled to help induce infiltration. New fabric and clean stone aggregate should be refilled.</li> </ul>	Upon failure



## Additional Information

Infiltration practices have historically had a high rate of failure compared to other stormwater management practices. One study conducted in Prince George's County, Maryland (Galli, 1992), revealed that less than half of the infiltration trenches investigated (of about 50) were still functioning properly, and less than one-third still functioned properly after 5 years. Many of these practices, however, did not incorporate advanced pretreatment. By carefully selecting the location and improving the design features of infiltration practices, their performance should improve.

It is absolutely critical that settleable particles and floatable organic materials be removed from runoff water before it enters the infiltration trench. The trench will clog and become nonfunctional if excessive particulate matter is allowed to enter the trench.

Cold climate considerations – see <http://www.cwp.org/cold-climates.htm>

## References

EPA, Stormwater Technology Fact Sheet - Infiltration Trench. EPA 832-F-99-019. September, 1999.

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Michigan Department of Environmental Quality. Infiltration Trench Factsheet. Available at: <http://www.deq.state.mi.us/documents/deq-swq-nps-it.pdf>

Montgomery County Department of Environmental Protection. Maintaining Urban Stormwater Facilities - A Guidebook for Common Ownership Communities. Available at: <http://www.montgomerycountymd.gov/mc/services/dep/Stormwater/maintain.htm>

Stormwater Managers Resource Center, Manual Builder. Available at: [http://www.stormwatercenter.net/intro\\_manual.htm](http://www.stormwatercenter.net/intro_manual.htm)

Stormwater Managers Resource Center. On-line: <http://www.stormwatercenter.net>

U.S. Department of Agriculture, Natural Resources Conservation Service. Illinois Urban Manual: A Technical Manual Designed for Urban Ecosystem Protection and Enhancement, 1995.

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Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually infiltrates into the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

## Inspection/Maintenance Considerations

Infiltration basins perform better in well-drained permeable soils. Infiltration basins in areas of low permeability can clog within a couple years, and require more frequent inspections and maintenance. The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system.

Scarification or other disturbance should only be performed when there are actual signs of clogging or significant loss of infiltrative capacity, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor. This BMP may require groundwater monitoring. Basins cannot be put into operation until the upstream tributary area is stabilized.

## Maintenance Concerns, Objectives, and Goals

- Vector Control
- Clogged soil or outlet structures
- Vegetation/Landscape Maintenance
- Groundwater contamination
- Accumulation of metals
- Aesthetics

## Targeted Constituents

- |                                     |                  |   |
|-------------------------------------|------------------|---|
| <input checked="" type="checkbox"/> | Sediment         | ■ |
| <input checked="" type="checkbox"/> | Nutrients        | ■ |
| <input checked="" type="checkbox"/> | Trash            | ■ |
| <input checked="" type="checkbox"/> | Metals           | ■ |
| <input checked="" type="checkbox"/> | Bacteria         | ■ |
| <input checked="" type="checkbox"/> | Oil and Grease   | ■ |
| <input checked="" type="checkbox"/> | Organics         | ■ |
| <input checked="" type="checkbox"/> | Oxygen Demanding | ■ |

## Legend (Removal Effectiveness)

- Low      ■ High  
▲ Medium



Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained.</li> <li>■ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition</li> </ul>	Semi-annual and after extreme events
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Factors responsible for clogging should be repaired immediately.</li> <li>■ Weed once monthly during the first two growing seasons.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Stabilize eroded banks.</li> <li>■ Repair undercut and eroded areas at inflow and outflow structures.</li> <li>■ Maintain access to the basin for regular maintenance activities.</li> <li>■ Mow as appropriate for vegetative cover species.</li> <li>■ Monitor health of vegetation and replace as necessary.</li> <li>■ Control mosquitoes as necessary.</li> <li>■ Remove litter and debris from infiltration basin area as required.</li> </ul>	Standard maintenance (as needed)
<ul style="list-style-type: none"> <li>■ Mow and remove grass clippings, litter, and debris.</li> <li>■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.</li> <li>■ Replant eroded or barren spots to prevent erosion and accumulation of sediment.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment.</li> <li>■ Seed or sod to restore ground cover.</li> <li>■ Disc or otherwise aerate bottom.</li> <li>■ Dethatch basin bottom.</li> </ul>	3-5 year maintenance



## **Additional Information**

In most cases, sediment from an infiltration basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children. Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

Light equipment, which will not compact the underlying soil, should be used to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This also prevents smearing of the basin floor.

## **References**

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: <ftp://dnr.metrokc.gov/wlr/dss/spcm/SPCM.HTM>

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

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Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## General Description

Retention/irrigation refers to the capture of stormwater runoff in a holding pond and subsequent use of the captured volume for irrigation of landscape or natural pervious areas. This technology is very effective as a stormwater quality practice in that, for the captured water quality volume, it provides virtually no discharge to receiving waters and high stormwater constituent removal efficiencies. This technology mimics natural undeveloped watershed conditions wherein the vast majority of the rainfall volume during smaller rainfall events is infiltrated through the soil profile. Their main advantage over other infiltration technologies is the use of an irrigation system to spread the runoff over a larger area for infiltration. This allows them to be used in areas with low permeability soils.

Capture of stormwater can be accomplished in almost any kind of runoff storage facility, ranging from dry, concrete-lined ponds to those with vegetated basins and permanent pools. The pump and wet well should be automated with a rainfall sensor to provide irrigation only during periods when required infiltration rates can be realized. Generally, a spray irrigation system is required to provide an adequate flow rate for distributing the water quality volume (LCRA, 1998). Collection of roof runoff for subsequent use (rainwater harvesting) also qualifies as a retention/irrigation practice.

## Inspection/Maintenance Considerations

Pollutant removal rates are estimated to be nearly 100% for all pollutants in the captured and irrigated stormwater volume. However, relatively frequent inspection and maintenance is necessary to verify proper operation of these facilities.

## Maintenance Concerns, Objectives, and Goals

- Sediment Accumulation
- Mechanical malfunction
- Vector Control

## Targeted Constituents

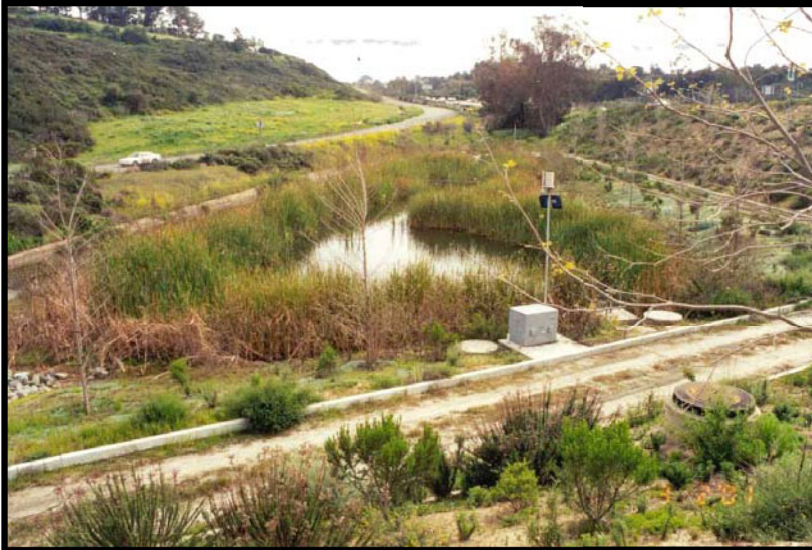
<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	■
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ The irrigation system should be inspected and tested (or observed while in operation) to verify proper operation multiple times annually. Two of these inspections should occur during or immediately following wet weather. Any leaks, broken spray heads, or other malfunctions with the irrigation system should be repaired immediately.</li> </ul>	Frequently (3-6 times per year)
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ The upper stage, side slopes, and embankment of a retention basin must be mowed regularly to discourage woody growth and control weeds.</li> </ul>	Frequently
<ul style="list-style-type: none"> <li>■ Remove sediment from inlet structure/sediment forebay, and from around the sump area at least 2 times annually or when depth reaches 3 inches. When sediment in other areas of the basin fills the volume allocated for sediment accumulation, all sediment should be removed and disposed of properly.</li> <li>■ Grass areas in and around basins must be mowed at least twice annually to limit vegetation height to 18 inches. More frequent mowing to maintain aesthetic appeal may be necessary in landscaped areas. When mowing is performed, a mulching mower should be used, or grass clippings should be caught and removed.</li> <li>■ Debris and litter will accumulate near the basin pump and should be removed during regular mowing operations and inspections. Particular attention should be paid to floating debris that can eventually clog the irrigation system.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ The pond side slopes and embankment may periodically suffer from slumping and erosion, although this should not occur often if the soils are properly compacted during construction. Regrading and revegetation may be required to correct the problems.</li> </ul>	Infrequently



## Maintenance Concerns, Objectives, and Goals

- Vegetation/Landscape Maintenance
- Endangered Species Habitat Creation
- Pollutant Removal Efficiency
- Clogging of the Outlet
- Invasive/exotic Plant Species
- Vector Control

## General Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

## Inspection/Maintenance Considerations

In order to maintain the pond's design capacity, sediment must be removed occasionally and adequate resources must be committed to properly maintain peripheral aquatic vegetation, control vector production, and to maintain effective pool volume. Wet ponds can become a nuisance due to mosquito and midge breeding unless carefully designed and maintained. A proactive and routine preventative maintenance plan (which can vary according to location) is crucial to minimizing vector habitat. A vegetated buffer should be preserved around the pond to protect the banks from erosion and provide some pollutant removal before runoff enters the pond by overland flow.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	▲
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events to confirm that the drainage system functions, and bank stability and vegetation growth are sufficient.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect for invasive vegetation, trash and debris, clogging of inlet/outlet structures, excessive erosion, sediment buildup in basin or outlet, cracking or settling of the dam, bank stability, tree growth on dam or embankment, vigor and density of the grass turf on the basin side slopes and floor, differential settlement, leakage, subsidence, damage to the emergency spillway, mechanical component condition, and graffiti.</li> </ul>	Semi-annual, after significant storms, or more frequent as needed
<ul style="list-style-type: none"> <li>■ Inspect condition of inlet and outlet structures, pipes, sediment forebays, basin, and upstream and downstream channel conditions. Monitor drain times, and check for algal growth, signs of pollution such as oil sheens, discolored water, or unpleasant odors, and signs of flooding.</li> </ul>	Annual inspection
<ul style="list-style-type: none"> <li>■ During inspections, note changes to the wet pond or the contributing watershed as these may affect basin performance.</li> </ul>	
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Introduce mosquito fish, <i>Gambusia</i> spp., (where permitted by the Department of Fish and Game or other agency regulations) to enhance natural mosquito and midge control and regularly maintain emergent and shoreline vegetation to provide access for vector inspectors and facilitate vector control if needed.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Perform vector control, if necessary.</li> <li>■ Remove sediment from outlet structure. Dispose of properly.</li> <li>■ Remove accumulated trash and debris in the basin, inlet/outlet structures, side slopes, and collection system as required.</li> <li>■ Repair undercut areas and erosion to banks and basin.</li> </ul>	Semi annual, after significant storm events
<ul style="list-style-type: none"> <li>■ Maintain protected vegetated buffer around pond. Mow side slopes and maintain vegetation in and around basin to prevent any erosion or aesthetic problems. Minimize use of fertilizers and pesticides. Reseed if necessary.</li> <li>■ Manage and harvest wetland plants.</li> <li>■ Structural repair or replacement, as needed.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Remove sediment from the forebay and regrade when the accumulated sediment volume exceeds 10-20% of the forebay volume. Clean in early spring so vegetation damaged during cleaning has time to re-establish.</li> </ul>	5- to 7-year maintenance
<ul style="list-style-type: none"> <li>■ Remove sediment when the permanent pool volume has become reduced significantly (sediment accumulation exceeds 25% of design depth), resuspension is observed, or the pond becomes eutrophic.</li> </ul>	>5 year maintenance

## Additional Information

In most cases, sediment from wet ponds do not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children.



Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

For the best water quality benefit, the pond should hold water for at least 24 hours. It should drain down to the permanent water level within 72 hours of a storm event to avoid conditions which might increase water temperatures, deplete oxygen, promote vector growth, and/or cause odors.

## References

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: <ftp://dnr.metrokc.gov/wlr/dss/spcm/SPCM.HTM>

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

Montgomery County Department of Environmental Protection. Maintaining Urban Stormwater Facilities - A Guidebook for Common Ownership Communities. Available at: <http://www.montgomerycountymd.gov/mc/services/dep/Stormwater/maintain.htm>

North Carolina Department of Environment and Natural Resources, Division of Water Quality. Maintaining Wet Detention Ponds Factsheet. Available at: [http://h2o.enr.state.nc.us/su/PDF\\_Files/Land\\_of\\_Sky\\_factsheets/FactSheet\\_7.pdf](http://h2o.enr.state.nc.us/su/PDF_Files/Land_of_Sky_factsheets/FactSheet_7.pdf)

Oregon Association of Clean Water Agencies, Oregon Municipal Stormwater Toolbox for Maintenance Practices, June 1998. Available at: <http://www.oracwa.org/Pages/toolbox.htm>

Stormwater Managers Resource Center. On-line: <http://www.stormwatercenter.net>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## General Description

Constructed wetlands are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from wet ponds primarily in being shallower and having greater vegetation coverage.

A distinction should be made between using a constructed wetland for storm water management and diverting storm water into a natural wetland. The latter practice is not recommended and in all circumstances, natural wetlands should be protected from the adverse effects of development, including impacts from increased storm water runoff. This is especially important because natural wetlands provide storm water and flood control benefits on a regional scale.

Wetlands are among the most effective stormwater practices in terms of pollutant removal and they also offer aesthetic value. As stormwater runoff flows through the wetland, pollutant removal is achieved through settling and biological uptake within the wetland. Flow through the root systems forces the vegetation to remove nutrients and dissolved pollutants from the stormwater.

## Inspection/Maintenance Considerations

Wetlands need a continuous base flow to maintain aquatic plants. Salts and scum can accumulate in wetlands and, unless properly designed and managed, can be flushed out during larger storms. Wetlands can also release nutrients during the non-growing season. Wetlands can become a breeding area for mosquitoes and midges unless carefully designed and maintained. A proactive and routine preventative maintenance plan (which can vary according to location) is crucial to minimizing vector habitat.

## Maintenance Concerns, Objectives, and Goals

- Vector/Pest Control
- Sediment and Trash Removal
- Vegetation/Landscape Maintenance
- Invasive Species Management
- Bank Erosion
- Nutrient Release During Winter
- Clogging of the Outlet

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	▲
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



To maximize wetland removal of pollutants, the vegetation must be harvested frequently. Harvesting is particularly important with respect to the removal of phosphorus and metals, less so for nitrogen. Harvesting should occur by mid-summer before the plants begin to transfer phosphorus from the aboveground foliage to subsurface roots, or begin to lose metals that desorb during plant die off. While not stated by the manufacturer, it is also desirable that every few years the entire plant mass including roots be harvested. This is because the below-ground biomass constitutes a significant reservoir (possibly half) of the nutrients and metals that are removed from the stormwater by plants (Minton, 2002).

If pretreatment is provided then maintenance consideration must be given to the build up of debris and floatables.



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events for bank stability, vegetation growth, drainage system functioning, and structural damage.</li> </ul>	After construction
<ul style="list-style-type: none"> <li>■ Inspect for invasive vegetation, differential settlement, cracking; erosion, leakage, or tree growth on the embankment; the condition of the riprap in the inlet, outlet, and pilot channels; sediment accumulation in the basin; clogging of outlet; and the vigor and density of the vegetation on the basin side slopes and floor. Correct observed problems as necessary.</li> </ul>	Semi-annual inspection
<ul style="list-style-type: none"> <li>■ Inspect for damage to the embankment and inlet/outlet structures. Repair as necessary.</li> <li>■ Note signs of hydrocarbon buildup such as floating oil on water surface.</li> <li>■ Monitor for sediment accumulation in the facility and forebay.</li> <li>■ Examine inlet and outlet devices to ensure they are free of debris and are operational.</li> </ul>	Annual inspection
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Replace wetland vegetation to maintain at least 50% surface area coverage in wetland plants after the second growing season.</li> </ul>	One-time
<ul style="list-style-type: none"> <li>■ Repair undercut areas, erosion to banks, and bottom as required.</li> <li>■ Where permitted by the Department of Fish and Game or other agency regulations, stock constructed wetlands regularly with mosquito fish (<i>Gambusia</i> spp.) to enhance natural mosquito and midge control</li> </ul>	As needed maintenance
<ul style="list-style-type: none"> <li>■ Clean and remove debris from inlet and outlet structures.</li> <li>■ Mow side slopes and remove grass clippings.</li> <li>■ Remove litter and debris from banks, basin bottom, trash racks, outlet structures, and valves as required.</li> </ul>	Frequent (3-4 times/year) maintenance
<ul style="list-style-type: none"> <li>■ Supplement wetland plants if a significant portion have not established (at least 50% of the surface area).</li> <li>■ Remove nuisance plant species.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Clean forebay to avoid accumulation in main wetland area to minimize when the main wetland area needs to be cleaned.</li> </ul>	5- to 7-year maintenance
<ul style="list-style-type: none"> <li>■ Harvest plant species if vegetation becomes too thick causing flow backup and flooding. More frequent plant harvesting may be required by local vector control agencies.</li> </ul>	5- to 7-year maintenance (or more frequently as required)
<ul style="list-style-type: none"> <li>■ Monitor sediment accumulations, and remove sediment when the accumulated sediment volume exceeds 10-20% of the basin volume, plants are “choked” with sediment, or the wetland becomes eutrophic. It is suggested that the main area be cleaned one half at a time with at least one growing season in between cleanings. This will help to preserve the vegetation and enable the wetland to recover more quickly from the cleaning.</li> </ul>	As needed maintenance (20- to 50-years)



## Additional Information

The following observations should be made during the inspections:

- Type and distribution of dominant wetland plants in the marsh
- The presence and distribution of planted wetland species
- The presence and distribution of invasive wetland species
- Signs that invasive species are replacing the planted wetland species
- Percentage of unvegetated standing water (excluding the deep water cells which are not suitable for emergent plant growth)
- The maximum elevation and the vegetative condition in this zone, if the design elevation of the normal pool is being maintained for wetlands with extended zones
- Stability of the original depth zones and the microtopographic features, accumulation of sediment in the forebay and micropool, and survival rate of plants in the wetland buffer.

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

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## Maintenance Concerns, Objectives, and Goals

- Vector/Pest Control
- Sediment and Trash Removal
- Vegetation/Landscape Maintenance
- Re-suspension of settled material
- Clogging of the Outlet

## General Description

Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the stormwater runoff from a water quality design storm for some minimum time (e.g., 72 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. They can also be used to provide flood control by including additional flood detention storage.

## Inspection/Maintenance Considerations

Inspections should be conducted semi-annually and after significant storm events to identify potential problems early. Most maintenance efforts will need to be directed toward vegetation management and vector control, which may focus on basic housekeeping practices such as removal of debris accumulations and vegetation management to ensure that the basin dewateres completely (recommended 72 hour residence time or less) to prevent creating mosquito and other vector habitats.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	▲
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	▲
<input checked="" type="checkbox"/>	Bacteria	▲
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	▲
<input checked="" type="checkbox"/>	Oxygen Demanding	▲

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after several storm events for bank stability, vegetation growth, and to determine if the desired residence time has been achieved.</li> <li>■ Inspect outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect for the following issues: differential settlement, cracking; erosion of pond banks or bottom, leakage, or tree growth on the embankment; the condition of the riprap in the inlet, clogging of outlet and pilot channels; standing water, slope stability, presence of burrows; sediment accumulation in the basin, forebay, and outlet structures; trash and debris, and the vigor and density of the grass turf on the basin side slopes and floor.</li> </ul>	Semi-annual, after significant storms, or more frequent
<ul style="list-style-type: none"> <li>■ Inspect for the following issues: subsidence, damage to the emergency spillway; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel, accumulated sediment volume, and semi-annual inspection items.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ During inspections, changes to the extended storage pond or the contributing watershed should be noted, as these may affect basin performance.</li> </ul>	Annual inspection
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ If necessary, modify the outlet orifice to achieve design values if inspection indicates modifications are necessary.</li> <li>■ Repair undercut or eroded areas.</li> <li>■ Mow side slopes.</li> <li>■ Manage pesticide and nutrients.</li> <li>■ Remove litter and debris.</li> <li>■ Control vectors as necessary.</li> </ul>	As needed
<ul style="list-style-type: none"> <li>■ Remove accumulated trash and debris from the basin, around the riser pipe, side slopes, embankment, emergency spillway, and outflow trash racks. The frequency of this activity may be altered to meet specific site conditions.</li> <li>■ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.</li> </ul>	Semi-annual, or more frequent, as needed
<ul style="list-style-type: none"> <li>■ Seed or sod to restore dead or damaged ground cover.</li> <li>■ Repair erosion to banks and bottom as required.</li> </ul>	Annual maintenance (as needed)
<ul style="list-style-type: none"> <li>■ Supplement wetland plants if a significant portion have not been established (at least 50% of the surface area).</li> <li>■ Remove nuisance plant species.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>■ Remove sediment from the forebay to reduce frequency of main basin cleaning.</li> </ul>	3- to 5-year maintenance
<ul style="list-style-type: none"> <li>■ Monitor sediment accumulation and remove accumulated sediment and regrade about every 10 years or when the accumulated sediment volume exceeds 10-20% of the basin volume, or when accumulation reaches 6 inches or if resuspension is observed. Clean in early spring so vegetation damaged during cleaning has time to re-establish.</li> </ul>	Every 10-25 years



## **Additional Information**

In most cases, sediment from extended detention basin does not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are likely to meet toxicity limits and can be safely landfilled or disposed of onsite. Onsite sediment disposal is always preferable (if local authorities permit it) as long as the sediments are deposited away from the shoreline to prevent their re-entry into the pond.

Sediments should be tested for toxin in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed.

## **References**

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.





## Maintenance Concerns, Objectives, and Goals

- Channelization
- Vegetation/Landscape Maintenance
- Vector Control
- Aesthetics
- Hydraulic and Removal Efficacy

## General Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for residential, industrial, and commercial areas with low flow and smaller populations.

## Inspection/Maintenance Considerations

It is important to consider that a thick vegetative cover is needed for vegetated swales to function properly. Usually, swales require little more than normal landscape maintenance activities such as irrigation and mowing to maintain pollutant removal efficiency. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g., debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained. The application of fertilizers and pesticides should be minimized.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	▲
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	●
<input checked="" type="checkbox"/>	Metals	▲
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	▲
<input checked="" type="checkbox"/>	Oxygen Demanding	▲

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
■ Inspect after seeding and after first major storms for any damages.	Post construction
■ Inspect for signs of erosion, damage to vegetation, channelization of flow, debris and litter, and areas of sediment accumulation. Perform inspections at the beginning and end of the wet season. Additional inspections after periods of heavy runoff are desirable.	Semi-annual
■ Inspect level spreader for clogging, grass along side slopes for erosion and formation of rills or gullies, and sand/soil bed for erosion problems.	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Mow grass to maintain a height of 3–4 inches, for safety, aesthetic, or other purposes. Litter should always be removed prior to mowing. Clippings should be composted.</li> <li>■ Irrigate swale during dry season (April through October) or when necessary to maintain the vegetation.</li> <li>■ Provide weed control, if necessary to control invasive species.</li> </ul>	As needed (frequent, seasonally)
<ul style="list-style-type: none"> <li>■ Remove litter, branches, rocks blockages, and other debris and dispose of properly.</li> <li>■ Maintain inlet flow spreader (if applicable).</li> <li>■ Repair any damaged areas within a channel identified during inspections. Erosion rills or gullies should be corrected as needed. Bare areas should be replanted as necessary.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Declog the pea gravel diaphragm, if necessary.</li> <li>■ Correct erosion problems in the sand/soil bed of dry swales.</li> <li>■ Plant an alternative grass species if the original grass cover has not been successfully established. Reseed and apply mulch to damaged areas.</li> </ul>	Annual (as needed)
<ul style="list-style-type: none"> <li>■ Remove all accumulated sediment that may obstruct flow through the swale. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation, or once it has accumulated to 10% of the original design volume. Replace the grass areas damaged in the process.</li> <li>■ Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.</li> </ul>	As needed (infrequent)

## **Additional Information**

Recent research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

## **References**

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

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## Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species Management
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

## General Description

Grassed buffer strips (vegetated filter strips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal. In addition, the public views them as landscaped amenities and not as stormwater infrastructure. Consequently, there is little resistance to their use.

## Inspection/Maintenance Considerations

Vegetated buffer strips require frequent landscape maintenance. In many cases, vegetated buffer strips initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor. Maintenance requirements typically include grass or shrub-growing activities such as irrigation, mowing, trimming, removal of invasive species, and replanting when necessary. Buffer strips require more tending as the volume of sediment increases. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless designed to dewater completely in 72 hours or less) and/or if proper drainage slopes are not maintained.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	▲
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	▲
<input checked="" type="checkbox"/>	Oxygen Demanding	▲

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium





Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Once the vegetated buffer strip is established, inspect at least three times per year. Repair all damage immediately.</li> <li>■ Inspect buffer strips after seeding and repair as needed.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Inspect buffer strip and repair all damage immediately.</li> <li>■ Inspect soil and repair eroded areas.</li> </ul>	After major storms
<ul style="list-style-type: none"> <li>■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.</li> <li>■ Inspect pea-gravel diaphragm/level spreader for clogging and effectiveness and remove built-up sediment.</li> <li>■ Inspect for rolls and gullies. Immediately fill with topsoil, install erosion control blanket and seed or sod.</li> <li>■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.</li> <li>■ Check for debris and litter, and areas of sediment accumulation.</li> </ul>	Semi-annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Water plants daily for 2 weeks after construction.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Mow regularly to maintain vegetation height between 2 - 4 inches, and to promote thick, dense vegetative growth. Cut only when soil is dry to prevent tracking damage to vegetation, soil compaction and flow concentrations. Clippings are to be removed immediately after mowing.</li> <li>■ Remove all litter, branches, rocks, or other debris. Damaged areas of the filter strip should be repaired immediately by reseeding and applying mulch.</li> <li>■ Regularly maintain inlet flow spreader.</li> <li>■ Irrigate during dry season (April through October) when necessary to maintain the vegetation.</li> </ul>	Frequently, as needed
<ul style="list-style-type: none"> <li>■ Remulch void areas.</li> <li>■ Treat diseased trees and shrubs, remove dead vegetation.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Remove sediment and replant in areas of buildup. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation.</li> <li>■ Limit fertilizer applications based on plant vigor and soil test results.</li> <li>■ Rework or replant buffer strip if concentrated flow erodes a channel through the strip.</li> </ul>	Annual

## **Additional Information**

Recent research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

## **References**

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: [cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

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## Maintenance Concerns, Objectives, and Goals

- Clogged Soil or Outlet Structures
- Invasive Species
- Vegetation/Landscape Maintenance
- Erosion
- Channelization of Flow
- Aesthetics

## General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

## Inspection/Maintenance Considerations

Bioretention requires frequent landscaping maintenance, including measures to ensure that the area is functioning properly, as well as maintenance of the landscaping on the practice. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. In many cases, maintenance tasks can be completed by a landscaping contractor, who may already be hired at the site. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	▲
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	■
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect soil and repair eroded areas.</li> </ul>	Monthly
<ul style="list-style-type: none"> <li>■ Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.</li> </ul>	Semi-annual inspection
<ul style="list-style-type: none"> <li>■ Inspect to ensure grass is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.</li> </ul>	
<ul style="list-style-type: none"> <li>■ Check for debris and litter, and areas of sediment accumulation.</li> </ul>	
<ul style="list-style-type: none"> <li>■ Inspect health of trees and shrubs.</li> </ul>	
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Water plants daily for 2 weeks.</li> </ul>	At project completion
<ul style="list-style-type: none"> <li>■ Remove litter and debris.</li> </ul>	Monthly
<ul style="list-style-type: none"> <li>■ Remove sediment.</li> <li>■ Remulch void areas.</li> <li>■ Treat diseased trees and shrubs.</li> <li>■ Mow turf areas.</li> <li>■ Repair erosion at inflow points.</li> <li>■ Repair outflow structures.</li> <li>■ Unclog underdrain.</li> <li>■ Regulate soil pH regulation.</li> </ul>	As needed
<ul style="list-style-type: none"> <li>■ Remove and replace dead and diseased vegetation.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Add mulch.</li> <li>■ Replace tree stakes and wires.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ Mulch should be replaced every 2 to 3 years or when bare spots appear. Remulch prior to the wet season.</li> </ul>	Every 2-3 years, or as needed

## Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: <http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>



Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, revised February, 2002.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at:  
[cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## Maintenance Concerns, Objectives, and Goals

- Pollutant Breakthrough
- Clogged of Sand Media
- Trash and Debris Accumulation

## General Description

Stormwater media filters are usually two-chambered including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media. As stormwater flows into the first chamber, large particles settle out, and then finer particles and other pollutants are removed as stormwater flows through the filtering media in the second chamber. There are a number of design variations including the Austin sand filter, Delaware sand filter, and multi-chambered treatment train (MCTT).

## Inspection/Maintenance Considerations

Media filters may exhibit decreased effectiveness after a few years of operation, depending on the activities occurring in the drainage area. Media filters clog easily when subjected to high sediment loads. Sediment reducing pretreatment practices, such as vegetated buffer strips or vegetated swales, placed upstream of the filter should be maintained properly to reduce sediment loads into filter. Media filters can become a nuisance due to mosquito or midge breeding if not properly designed and maintained. Installations should dewater completely (recommended 72 hour or less residence time) to prevent creating mosquito and other vector habitats. Maintenance efforts will need to focus on basic housekeeping practices such as removal of debris accumulations and vegetation management (in filter media) to prevent clogs and/or pods of standing water. To minimize the potential for clogging, frequent maintenance and inspection practices are required. Waste sand, gravel, filter cloth, or filter media must be disposed of properly and in accordance with all applicable laws.

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	■
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	■
<input checked="" type="checkbox"/>	Metals	■
<input checked="" type="checkbox"/>	Bacteria	▲
<input checked="" type="checkbox"/>	Oil and Grease	■
<input checked="" type="checkbox"/>	Organics	■
<input checked="" type="checkbox"/>	Oxygen Demanding	■

## Legend (Removal Effectiveness)

- Low
- High
- ▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ During the first year of operation, inspect chambers quarterly to ensure that the system is functioning properly.</li> <li>■ Inspect sand filters after every major storm in the first few months after construction to ensure that the system is functioning properly.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>■ Ensure that filter surface, inlets, and outlets are clear of debris.</li> <li>■ Ensure that the contributing area is stabilized and mowed, with clippings removed.</li> <li>■ Check to ensure that the filter surface is not clogging.</li> <li>■ Ensure that activities in the drainage area minimize oil/grease and sediment entry to the system.</li> <li>■ Inspect the facility once during the wet season after a large rain event to determine whether the facility is draining completely within 72 hr.</li> </ul>	Quarterly, and after major storms
<ul style="list-style-type: none"> <li>■ Inspect for standing water, sediment, trash and debris, structural damage, and to identify potential problems.</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Check to see that the filter bed is clean of sediments and the sediment chamber contains no more than six inches of sediment.</li> <li>■ Make sure that there is no evidence of deterioration of concrete structures.</li> <li>■ Inspect grates (if used).</li> <li>■ Inspect inlets, outlets, and overflow spillway to ensure good condition and no evidence of erosion.</li> <li>■ Ensure that flow is not bypassing the facility.</li> <li>■ Ensure that no noticeable odors are detected outside the facility.</li> </ul>	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Remove trash and debris from the sedimentation basin (Austin design), the riser pipe, and the filter bed as needed.</li> <li>■ Prevent grass clippings from washing into the filter.</li> <li>■ Remove trash from inlet grates to maintain the inflow capacity of the media filter.</li> <li>■ Upstream vegetation should be maintained as needed.</li> </ul>	Frequently (as needed)
<ul style="list-style-type: none"> <li>■ Clean filter surface semiannually; or more often if watershed is excessively erosive.</li> <li>■ Replace sorbent pillows (Multi-Chamber Treatment Train only).</li> </ul>	Semi-annual
<ul style="list-style-type: none"> <li>■ Repair or replace any damaged structural parts.</li> <li>■ Stabilize any eroded areas.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>■ Remove accumulated sediment in the sedimentation chamber every 10 years or when the sediment occupies 10-20% of the basin volume or accumulates to a depth of six inches, whichever is less.</li> <li>■ Remove top 2 in. of media filter and landfill if facility drain time exceeds 72 hr. Restore media depth to 18 in. when overall media depth drops to 12 in.).</li> </ul>	As needed

## References

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at:  
<http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm>

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at:  
[http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp\\_files.cfm](http://www.cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm)

Ventura Countywide Stormwater Quality Management Program, Technical Guidance Manual for Stormwater Quality Control Measures. July, 2002.



## General Description

Water quality inlets (WQIs), also commonly called trapping catch basins, oil/grit separators or oil/water separators, consist of one or more chambers that promote sedimentation of coarse materials and separation of free oil (as opposed to emulsified or dissolved oil) from stormwater. Some WQIs also contain screens to help retain larger or floating debris, and many of the newer designs also include a coalescing unit that helps promote oil/water separation.

These devices are appropriate for capturing hydrocarbon spills, but provide very marginal sediment removal and are not very effective for treatment of stormwater runoff. WQIs typically capture only the first portion of runoff for treatment and are generally used for pretreatment before discharging to other best management practices (BMPs).

## Inspection/Maintenance Considerations

High sediment loads can interfere with the ability of the WQI to effectively separate oil and grease from the runoff. During periods of high flow, sediment can be resuspended and released from the WQI into surface waters. Maintenance of WQIs can be easily neglected because they are underground. Establishment of a maintenance schedule is helpful for ensuring proper maintenance occurs. The required maintenance effort will be site-specific due to variations in sediment and hydrocarbon loading. Since WQI residuals contain hydrocarbon by-products, they may require disposal as hazardous waste. Many WQI owners coordinate with waste haulers to collect and dispose of these residuals.

## Maintenance Concerns, Objectives, and Goals

- High Sediment Loads
- Hazardous Waste
- Vector Control

## Targeted Constituents

<input checked="" type="checkbox"/>	Sediment	●
<input checked="" type="checkbox"/>	Nutrients	●
<input checked="" type="checkbox"/>	Trash	▲
<input checked="" type="checkbox"/>	Metals	●
<input checked="" type="checkbox"/>	Bacteria	●
<input checked="" type="checkbox"/>	Oil and Grease	▲
<input checked="" type="checkbox"/>	Organics	●
<input checked="" type="checkbox"/>	Oxygen Demanding	●

### Legend (Removal Effectiveness)

- Low      ■ High  
▲ Medium



Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Inspect after every storm event to determine if maintenance is required.</li> </ul>	Monthly during the wet season, or after significant rain events
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>■ Clean out and dispose of accumulated oil, grease, and sediments. Remove accumulated trash and debris. The clean out and disposal techniques should be environmentally acceptable and in accordance with local regulations.</li> </ul>	Annual, before the wet season, or more frequent as needed

## Additional Information

Since WQIs can be relatively deep, they may be designated as confined spaces. Caution should be exercised to comply with confined space entry safety regulations if it is required.

## References

<http://www.co.pierce.wa.us/pc/services/home/envIRON/water/swm/sppman/bmpt1.htm>

## General Description

A multiple treatment system uses two or more BMPs in series. Some examples of multiple systems include: settling basin combined with a sand filter; settling basin or biofilter combined with an infiltration basin or trench; extended detention zone on a wet pond.

## Inspection/Maintenance Considerations

Each of the separate treatment processes will require maintenance as described in the previous fact sheets. For example, multiple system comprises of a biofilter combined with an infiltration basin would require the inspection and maintenance considerations outlined on the fact sheet for each process.

Inspection Activities	Suggested Frequency
■ Refer to individual treatment control factsheets	As needed
Maintenance Activities	Suggested Frequency
■ Refer to individual treatment control factsheets	As needed

## Maintenance Concerns, Objectives, and Goals

May include the following:

- Accumulation of Metals
- Aesthetics
- Channelization of Flow
- Clogging of the Outlet
- Endangered Species Habitat Creation
- Erosion
- Groundwater Contamination
- Hazardous Waste
- Hydraulic and Removal Efficiency
- Invasive Species Management
- Mechanical Malfunction
- Pollutant Breakthrough
- Re-suspension of settled material
- Sediment and Trash Removal
- Sedimentation
- Vector/Pest Control
- Vegetation harvesting
- Vegetation/Landscape Maintenance

## Targeted Constituents

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Sediment         | ■ |
| <input checked="" type="checkbox"/> Nutrients        | ● |
| <input checked="" type="checkbox"/> Trash            | ■ |
| <input checked="" type="checkbox"/> Metals           | ■ |
| <input checked="" type="checkbox"/> Bacteria         | ▲ |
| <input checked="" type="checkbox"/> Oil and Grease   | ■ |
| <input checked="" type="checkbox"/> Organics         | ■ |
| <input checked="" type="checkbox"/> Oxygen Demanding | ■ |

Legend (Removal Effectiveness)

- Low      ■ High  
▲ Medium



# **Section 5**

## **BMP Implementation and Evaluation**

### **5.1 Introduction**

As noted in Section 1 each municipality regulated under stormwater NPDES permits, whether categorized as a Phase I or Phase II municipality, is required to implement a stormwater management program and to assess the effectiveness of the program. Although specific program requirements and the level of implementation required differ between Phase I and Phase II municipalities, both prohibit non-stormwater discharges into storm drains, and require controls to reduce the discharge of pollutants to the maximum extent practicable (MEP). As part of the program, the municipalities are required to address public agency (municipal) operations to reduce the discharge of pollutants and to assess these efforts. Section 2 provides information on some of the necessary elements and steps involved in identifying BMPs for municipal activities occurring at fixed facilities and in field programs, whereas this Section discusses the components necessary to successfully implement a BMP and evaluate its effectiveness.

### **5.2 BMP Implementation**

Municipal employees perform numerous municipal activities that have the potential to discharge pollutants. Staff should consistently implement the procedures or BMPs applicable to these activities. Some municipal activities are contracted to other parties. For example, many municipalities contract out street sweeping or waste collection. Similarly, many municipalities lease city-owned facilities to other parties, at which activities take place that have the potential to discharge pollutants. To ensure measures are taken to reduce pollutants while contractors or lessees perform such activities, contract and lease language should explicitly specify requirements to comply with all BMP specifications. Sample contract/lease language is presented in Appendix D.

Successful implementation of a BMP is dependent on the following components:

- Effective training of municipal and contract employees working in both fixed facilities and field programs.
- Regular inspections of fixed facilities, field programs, and treatment controls.
- Maintenance of treatment controls as needed to ensure proper functioning.
- Periodic evaluation/monitoring of BMP performance consistent with NPDES permit requirements.
- Follow-up action to correct deficiencies in BMP implementation noted during inspections.
- Accurate record keeping to track training, inspections, monitoring, and BMP maintenance.
- Submittal of an annual report to the applicable RWQCB regarding the effectiveness of the municipal efforts to reduce pollutants from fixed facilities and field programs.



- For Phase II Programs, documentation showing how the municipality has met its measurable goals, or revisions to those goals with supporting documentation.

## 5.3 Staff Training

Education and training is the key to the success of BMP implementation. Typically, municipalities provide annual training sessions. In addition to municipally sponsored training, staff may also attend local, regional, statewide, or national training seminars or workshops related to stormwater management and water quality conducted by other organizations.

In general, a municipality should consider a training program for employees working in fixed facilities and/or field programs. The training program should address the following subjects:

- **Maintenance Procedure Implementation and Inspection** – In this training effort, proper procedures for performing municipal activities that may adversely affect stormwater quality are addressed. Maintenance procedures cover a wide range of municipal activities and the training may address either all maintenance procedures applicable to the municipality or a specific procedure (e.g. fertilizer and pesticide use). This training can be conducted in either a formal or a tailgate-style format.
- **Pollution Prevention/Spill Awareness** – This training addresses the general techniques municipal staff may implement to prevent pollution, as well as to respond to spills once they have occurred. Training can be tailored to management and other municipal staff who oversee pollution prevention measures, to field staff conducting activities that may result in spills, or to field staff who may encounter spills or illicit discharges.

## 5.4 Site Inspections

Inspections of municipal fixed facilities and field programs should be performed to verify that BMPs are being implemented, that they are appropriate for that facility or program, and that they continue to reduce the discharge of pollutants. Inspections generally consist of the following:

- **Fixed Facilities** – Inspections are typically performed by a combination of stormwater program staff and on-site fixed facility managers. The inspection of a fixed facility may include spot checks of the facility and activities being performed at the facility, and interviews with key line staff.
- **Field Programs** – Inspections are typically performed by a combination of stormwater program staff and field program supervisors. The inspection of a field program may include spot checks of activities being performed, and interviews with key staff.
- **Contracted Activities** – Inspections are typically performed by municipal staff to supplement and check on self-inspections and reporting by the management staff of the contract firm performing the activity. Performance should be checked against contract/lease language (see Appendix D).

- **Leased Facilities** – Inspections are typically performed by municipal staff to supplement and check on self-inspections and reporting by the management staff of the lessor (see Appendix D).

### 5.4.1 Inspection Frequencies

Fixed facility or field program inspection frequency depends on the nature of the facility or program. Annual inspection is typical, with a more frequent schedule for facilities/activities that pose a greater threat to discharge pollutants (e.g. corporation yards). In the event of an observed problem, such as ineffective maintenance procedures or detected non-stormwater discharges, the inspection frequency should be increased as appropriate to facilitate correction of the problem (see section 5.7 for discussion regarding follow-up enforcement).

### 5.4.2 Inspection Documentation Procedures

Inspection forms may be developed and used to properly document all inspections and gather the necessary information for record keeping and annual reporting. Examples include:

- **General Inspection Forms** – These primary forms provide for a general characterization of the fixed facility or field program being inspected, including the type of facility or program, the reason for inspection, activities that may take place, and BMPs applicable for the facility. A general form for all inspections and a single fixed facility specific form should be completed.
- **Activity Specific Inspection Forms** – These secondary forms include a series of questions or checklist items about specific activities taking place at a fixed facility or as part of a field program, as well as a list of suggested corrective action plans that can be implemented should a problem be found. All forms applicable to the activities being performed at a fixed facility or field program should be completed.

## 5.5 Treatment Control BMP Maintenance

Maintenance of treatment controls and drainage conveyance systems (e.g. detention and retention basins, infiltration devices, catch basins) including regular inspections as presented in Section 4, is needed to maintain efficient pollutant reduction. If treatment control BMPs are not properly maintained, BMP effectiveness is reduced and water quality deteriorates. Training should be provided where needed. Maintenance schedules should be periodically reviewed and updated as needed to maintain BMP effectiveness. Where regular scheduled maintenance is not appropriate, regular inspections should be scheduled to determine when repairs, cleaning, or replacement are necessary. See Section 4 for a comprehensive discussion regarding maintenance of treatment control BMPs.

Where municipal contractors are responsible for maintenance of treatment controls, special attention should be directed toward ensuring proper maintenance procedures are implemented. Contract and lease language should include recommended maintenance procedures and schedules. Regularly scheduled inspections of facilities or programs operated by the contractor should include compliance with BMP maintenance requirements.



## 5.6 Analytical Monitoring

Although expensive, stormwater monitoring is a valuable way to assess long-term BMP effectiveness and cost-effectiveness of selected BMPs at reducing pollutants to the “maximum extent practicable”. For Phase I municipalities, specific monitoring requirements depend on the individual NPDES permits issued. Phase II municipalities are covered by the Phase II General NPDES Permit and are not explicitly required to conduct chemical monitoring. Monitoring activities can include source identification, and chemical characterization of effluent/runoff, and non-stormwater discharges.

It is beyond the scope of this handbook to describe specific sampling and analytical techniques. For guidance on conventional stormwater sampling techniques and protocol, the reader should refer to NPDES Stormwater Sampling Guidance Document, 1992, published by the USEPA, or Caltrans’ Guidance Manual: Stormwater Monitoring Protocols, 2000.

## 5.7 Enforcement

To ensure proper BMP performance, enforcement procedures and mechanisms should be established for the municipal fixed facilities and field programs. Enforcement actions may occur as a result of a problem found during an inspection or in response to a complaint that is received. Several different types of enforcement mechanisms and penalties can be utilized to ensure compliance. The internal enforcement procedures, directed toward municipal staff, include initial verbal warnings, written warnings, and more serious disciplinary actions if verbal and written warnings do not result in appropriate action. External enforcement procedures which pertain to municipal contractors may be undertaken primarily by the municipality’s inspectors, managers, and supervisors who possess enforcement authority through established policies and procedures or ordinances. Depending on the severity of the violation, enforcement could range from the issuance of a notice of noncompliance to the loss of a contract or lease, or a fine.

## 5.8 Recordkeeping

As applicable, the municipality should maintain records demonstrating successful implementation of BMPs. Recordkeeping may include training, site inspection and maintenance, and if applicable, monitoring.

### Training and Workshops

Records of all training sessions provided to staff should be maintained to allow for:

- determining which staff requires which training;
- determining when training sessions must be conducted; and
- documenting training activities for enforcement and compliance purposes.

Municipal staff may attend training sessions or workshops sponsored by non-Permittees such as local or national organizations. For these sessions, the following information should be recorded:

- Name of Workshop/Training
- Sponsoring Organization
- General Description of the Subject Matter
- Location
- Date
- Attendee information (name, title, department, phone and/or email)

### **Site Inspection and BMP Maintenance**

Inspection reports should be kept to track frequency and results of inspections, BMPs implemented, condition of BMPs inspected, and follow-up actions taken. It is also important to keep a record of maintenance activities or any other BMPs that are of an “action” nature. It is easy to demonstrate that a BMP that involves a physical change, such as berming or covering, has been accomplished. However, actions that relate to good housekeeping can only be demonstrated by recordkeeping. Besides demonstrating compliance, records can assist in BMP management. Keeping a record of catch basin cleaning, for example, also provides insight into how long it takes for the catch basin sump to refill.

### **Monitoring**

Records of all stormwater monitoring information, inspections and visual observations, certifications, corrective actions and follow-up activities, and copies of all reports must be retained for a period of at least five years. These records shall include at a minimum, when applicable:

- Date, place, and time of sampling, visual observations, and/or measurements.
- Individual(s) who performed the sampling, visual observations, and or measurements.
- Visual observation records for storm events.
- Visual observations and inspections of non-stormwater discharges.
- Calibration and maintenance records of on-site instruments used.
- Visual observations and sample collection exception records,
- Date and approximate time of analyses.
- Individual who performed the analyses.
- Analytical results, method detection limits, and the analytical techniques or methods used.
- Quality assurance/quality control records and results.



- Sampling and analysis exemption and reduction certifications and supporting documentation.
- Records of any corrective actions and follow-up activities that resulted from the visual observations.

## 5.9 Reporting

Phase I municipalities are required to submit annual reports documenting BMP implementation, with due dates varying depending on individual NPDES permit requirements. Specific reporting requirements differ between individual permits. Typically, they include, but are not limited to, the following:

- Program implementation status.
- Summary of stormwater activities performed.
- Stormwater monitoring results summary and analysis.
- Assessment of the effectiveness of selected control measures or BMPs.
- Changes or suggested changes to the BMP that will improve overall effectiveness of the program.

Phase II municipalities will be required under the Phase II General NPDES Permit, beginning in 2004, to submit annual reports to the appropriate RWQCB by August 15th of each year, or as otherwise required by the RWQCB executive officer. Specific reporting requirements will include:

- Program implementation status.
- Summary of stormwater activities performed.
- Results of information collected, such as monitoring data.
- Summary of proposed stormwater activities for the next reporting cycle.
- Changes made in BMP selection.
- Changes in stormwater management personnel.
- Changes made in program or measurable goals.

# Section 6

## Glossary and List of Acronyms

### 6.1 Glossary

**303(d) Listed:** Water bodies listed as impaired as per Section 303(d) of the 1972 Clean Water Act.

**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.

**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.

**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.

**Construction Activity:** Includes clearing, grading, excavation, and contractor activities that result in soil disturbance.

**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 five acres or more. Threshold lowered to one acre beginning October 10, 2003. Construction General Permit No. CAS000002.

**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 capture and subsequent release of stormwater runoff from the site at a slower rate than it is collected, the difference being held in temporary storage.

**Discharge:** A release or flow of stormwater or other substance from a conveyance system or storage container. Broader – includes release to storm drains, etc.

**Effluent Limits:** Limitations on amounts of pollutants that may be contained in a discharge. Can be expressed in a number of ways including as a concentration, as a concentration over a time period (e.g., 30-day average must be less than 20 mg/l), or as a total mass per time unit, or as a narrative limit.

**Erosion:** The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by land-clearing practices related to farming, new development, redevelopment, road building, or timber cutting.

**Facility:** Is a collection of industrial processes discharging stormwater associated with industrial activity within the property boundary or operational unit.

**Grading:** The cutting or filling of the land surface to a desired slope or elevation.

**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 EPA or state lists. Regulated under the federal Resource Conservation and Recovery Act and the California Health and Safety Code.

**Illicit Discharges:** Any discharge to a municipal separate storm sewer that is not in compliance with applicable laws and regulations as discussed in this document.

**Industrial General Permit:** A National Pollutant Discharge Elimination System (NPDES) Permit (No. CAS000001) issued by the State Water Resources Control Board for discharge of stormwater associated with industrial activity. Board Order 97-03-DWQ.

**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.

**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 storm water; (ii) which is not a combined sewer; and (iii) which is not part of a Publicly Owned Treatment Works (POTW) as defined at Title 40 of the Code of Federal Regulations (CFR) 122.2. A “Small MS4” is defined as an MS4 that is not a permitted MS4 under the Phase I regulations. This definition of a Small MS4 applies to MS4 operated within cities and counties as well as governmental facilities that have a system of storm sewers.

**Non-Stormwater Discharge:** Any discharge to municipal separate storm sewer that is not composed entirely of stormwater.

**Nonpoint Source Pollution:** Pollution that does not come from a point source. Nonpoint source pollution originates from aerial diffuse sources that are mostly related to land use.

**Notice of Intent (NOI):** A formal notice to SWRCB submitted by the owner of an industrial site or construction site that said owner seeks coverage under a General Permit for discharges associated with industrial and construction activities. The NOI provides information on the



owner, location, type of project, and certifies that the owner will comply with the conditions of the construction General Permit.

**Notice of Termination (NOT):** Formal notice to SWRCB submitted by owner/ developer that a construction project is complete.

**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 Clean Water Act (CWA). In California, the State Water Resources Control Board (SWRCB) has issued a General Permit for stormwater discharges associated with industrial activities (see Appendix A).

**Outfall:** The end point where storm drains discharge water into a waterway.

**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.

**Precipitation:** Any form of rain or snow.

**Pretreatment:** Treatment of waste stream before it is discharged to a collection system.

**Reclaim (water reclamation):** Planned use of treated effluent that would otherwise be discharged without being put to direct use.

**Retention:** The storage of stormwater to prevent it from leaving the development site.

**Reuse (water reuse):** (see Reclaim)

**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:** Off site stormwater surface flow or other surface flow which enters your site.

**Scour:** The erosive and digging action in a watercourse caused by flowing water.

**Secondary Containment:** Structures, usually dikes or berms, surrounding tanks or other storage containers, designed to catch spilled materials from the storage containers.

**Sedimentation:** The process of depositing soil particles, clays, sands, or other sediments that were picked up by runoff.



**Sediments:** Soil, sand, and minerals washed from land into water, usually after rain, that collect in reservoirs, rivers, and harbors, destroying fish nesting areas and clouding the water, thus preventing sunlight from reaching aquatic plants. Farming, mining, and building activities without proper implementation of BMPs will expose sediment materials, allowing them to be washed off the land after rainfalls.

**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.

**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.

**Storm Drains:** Above- and below-ground structures for transporting stormwater to streams or outfalls for flood control purposes.

**Stormwater:** Defined as urban runoff and snowmelt runoff consisting only of those discharges, which originate from precipitation events. 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 Control Plan (SWPCP):** A less formal plan than the SWPPP that addresses the implementation of BMPs at facilities/businesses not covered by a general permit but that have the potential to discharge pollutants.

**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.

**Treatment Control BMPs:** Treatment methods to remove pollutants from stormwater.

**Toxicity:** Adverse responses of organisms to chemicals or physical agents ranging from mortality to physiological responses such as impaired reproduction or growth anomalies.

**Turbidity:** Describes the ability of light to pass through water. The cloudy appearance of water caused by suspended and colloidal matter (particles).

## 6.2 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
APHA	American Public Health Association
APWA	American Public Works Association
ARS	Agricultural Research Service
AQMD	Air Quality Management District
ASTM	American Society for Testing Materials
AWWA	American Water Works Association
BAT	Best Available Technology (economically available)
BCT	Best Conventional Technology (pollution control)
BFP	Bonded Fiber Matrix
BMPs	Best Management Practices
BOD	Biological Oxygen Demand
CA	Contractor Activities
CAL-EPA	California Environmental Protection Agency
CAL-OSHA	California Division of Occupational Safety and Health Administration
CASQA	California Stormwater Quality Association
CCR	California Code of Regulations

*Section 6*  
*Glossary and List of Acronyms*

CCS	Cellular Confinement System
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Register
CMA	Congestion Management Program
COE	U.S. Army Corps of Engineers
CPI	Coalescing Plate Interceptor
CWA	Clean Water Act (Federal Water Pollution Control Act of 1972 as amended in 1987)
DCIA	Directly Connected Impervious Area
DTSC	California Department of Toxic Substances Control
EEC	Effect Effluent Concentration
EIR	Environmental Impact Report
EMC	Event Mean Concentration
EOS	Equivalent Opening Size
ESA	Environmentally Sensitive Area
ESC	Erosion and Sedimentation Control
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GIS	Geographical Information System
Hazmat	Hazardous Material
HSG	Hydrologic Soil Groups
IPM	Integrated Pest Management
JURMP	Jurisdictional Urban Runoff Management Program
MEP	Maximum Extent Practicable

MS4	Municipal Separate Storm Sewer System
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NSF	National Science Foundation
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	Polycyclic Aromatic Hydrocarbons
PAM	Polyacrylamide
PCBs	Polychlorinated Biphenyls
PCC	Portland Concrete Cement
PPT	Pollution Prevention Team
POTW	Publicly Owned Treatment Works
PSD	Particle Size Distribution
RCRA	Resource Conservation and Recovery Act



*Section 6*  
*Glossary and List of Acronyms*

RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SIC	Standard Industrial Classification
SPCC	Spill Prevention Control and Countermeasure
SUSMP	Standard Urban Stormwater Mitigation Plan
SWMP	Stormwater Management Program
SWPCP	Stormwater Pollution Control Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UFC	Uniform Fire Code
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
WEF	Water Environment Federation

# **Appendix A**

## **Inventory of Municipal Operations**

This appendix provides an example of an inventory database. The purpose of this example is to illustrate the types of data that should be collected for municipal operations and how these data can be organized into a database that can be used for other steps of a municipality's stormwater management program. Specifically, the information gathered in the inventory process should be used to assess municipal operations for BMP implementation (Appendix B) and for BMP selection (Appendix C).

The example provided here was adapted from the inventory database developed by the County of Orange Stormwater Program for fixed facilities. The field program inventory database should include similar information (see Section 2).

## Step 1 Facility and Location

Facility Physical Address Information*										Watershed Identification		
Facility Name	Street Number	Street Name	Street Suffix	City	Zip	Business Phone Number	Business Fax Number	Facility Contact Name	Facility Size (Total Square Feet of Facility)	Watershed (Identify if possible)	Longitude (X)	Latitude (Y)
County Yard	1200	Pine	Road	Anaheim	92933	(714) 555-6363	(111) 222-3333	Ron Jones	400,000	E - Lower Santa Ana River	133.49.55	34.34.45
City Service Center	645	Main	Street	Brea	92821	(714) 555-1234	(123) 456-7890	Joe Smith	200,000	A - San Gabriel River/Coyote Creek	102.48.50	33.34.44

\* Add facility mailing address information if different from physical address

## Step 2 Potential Pollutant Generating Activities

Identify all activities that apply for each facility and associated pollutants												
Facility Name	Vehicle and Equipment Fueling	Vehicle and Equipment Washing & Steam Cleaning	Vehicle & Equipment Maintenance and Repair	Outdoor Loading/ Unloading of Materials	Outdoor Container Storage of Liquids	Outdoor Process Equipment Operations & Maintenance	Outdoor Storage of Raw Materials	Waste Handling and Disposal	Building and Grounds Maintenance	Parking/ Storage Area Maintenance	Over Water Activities	
County yard	Metals, O&G, Org., Trash	Sed., Nut., Trash, Metals, O&G, Org.	Metals, O&G, Org.	Sed., Nut., Metals, O&G			Sed., Nut., Metals, O&G			Sed., Nut., Trash, Metals, Bact., O&G, Org., Oxy		
City Service Center	Metals, O&G, Org., Trash	Sed., Nut., Trash, Metals, O&G, Org.	Metals, O&G, Org.	Sed., Nut., Metals, O&G			Sed., Nut., Metals, O&G		Sed., Nut., Trash, Metals, Bact., O&G, Org., Pest., Oxy	Sed., Nut., Trash, Metals, Bact., O&G, Org., Oxy		

# **Appendix B**

## **Assessment of Municipal Operations**

This appendix provides an example assessment worksheet that can be used for evaluating fixed facilities to determine the level of BMP implementation. The results of this assessment process can then be used as the basis for BMP selection (see Appendix C).



# WORKSHEET 1

Facility Name: County yard  
Contact Name: Ron Jones

Site Address: 1200 Pine Rd., Anaheim, CA 92933  
Phone: (111) 222-3333

**1. ACTIVITIES** – In the table below check each activity present at the site and evaluate its potential for pollutant discharge (PPD): 1 = high potential, 2= medium potential, 3= low potential

**2. BMP EFFECTIVENESS** – In the table below provide an effectiveness rating using the provided scale.

ACTIVITY AND BMP CHECKLIST				
	APPLICABLE ACTIVITY			EFFECTIVENESS RATING *
	Yes	No	PPD	
<b>A. VEHICLE AND EQUIPMENT FUELING</b> BMPs employed: <ul style="list-style-type: none"> <li>Employees trained in proper fueling and cleanup procedures.</li> <li>“Shut-off” valves installed on nozzles.</li> <li>“Topping off” of fuel tanks is discouraged.</li> <li>Adsorbent materials used on spills as opposed to hosing down.</li> <li>Drains labeled within the facility boundary, by stencil to indicate whether they flow to an oil/water separator, directly to the sewer, or to a storm drain.</li> <li>Fueling area designed to prevent storm water runoff and spills.</li> <li>Fueling area covered with an overhanging roof structure.</li> </ul>	[ x ]	[ ]	[ 1 ]	① ② ③ ④ ⑤
<b>B. VEHICLE AND EQUIPMENT WASHING/STEAM CLEANING</b> BMPs employed: <ul style="list-style-type: none"> <li>Vehicles and equipment are washed at an off-site commercial washing location whenever possible.</li> <li>On-site washing area is clearly marked as a wash area.</li> <li>Signs are posted stating that only washing is allowed in wash area and that discharges to the storm drain are prohibited.</li> <li>Trash containers are provided in wash area.</li> <li>A map of on-site storm drain locations exists to avoid discharges to the storm drain system.</li> </ul>	[ x ]	[ ]	[ 2 ]	① ② ③ ④ ⑤
<b>C. VEHICLE AND EQUIPMENT MAINTENANCE AND REPAIR</b> BMPs employed: <ul style="list-style-type: none"> <li>Idle equipment is stored under cover.</li> <li>Drip pans are used for leaking vehicle/equipment.</li> <li>Vehicle maintenance area is designed to prevent storm water pollution (area contains berming and appropriate drainage routing).</li> <li>Signs are painted on storm drain inlets to indicate that they are not to receive liquid or solid wastes.</li> <li>The work area is covered to limit exposure to the rain.</li> </ul>	[ x ]	[ ]	[ 1 ]	① ② ③ ④ ⑤
<b>D. OUTDOOR LOADING/UNLOADING OF MATERIALS</b> BMPs employed:	[ ]	[ x ]	[ ]	① ② ③ ④ ⑤
<b>E. OUTDOOR CONTAINER STORAGE OF LIQUIDS</b> BMPs employed:	[ ]	[ x ]	[ ]	① ② ③ ④ ⑤
<b>F. OUTDOOR PROCESS EQUIPMENT OPERATIONS AND MAINTENANCE</b> BMPs employed:	[ ]	[ x ]	[ ]	① ② ③ ④ ⑤
<b>G. OUTDOOR STORAGE OF RAW MATERIALS</b> BMPs employed: <ul style="list-style-type: none"> <li>Materials are stored inside when feasible.</li> <li>All outside storage areas are covered with a roof or enclosed to prevent stormwater contact.</li> <li>Outdoor storage containers are kept in good condition.</li> <li>Lids are secured on waste barrels and containers.</li> <li>Drums are stored in a secure area where unauthorized persons cannot gain access.</li> </ul>	[ x ]	[ ]	[ 2 ]	① ② ③ ④ ⑤
<b>H. WASTE HANDLING AND DISPOSAL</b> BMPs employed:	[ ]	[ x ]	[ - ]	① ② ③ ④ ⑤
<b>I. BUILDING AND GROUNDS MAINTENANCE</b> BMPs employed:	[ ]	[ x ]	[ - ]	① ② ③ ④ ⑤
<b>J. PARKING/STORAGE AREA MAINTENANCE</b> BMPs employed: <ul style="list-style-type: none"> <li>Parking and storage areas are kept clean and orderly.</li> <li>Site is designed to allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.</li> <li>Rooftop drains are arranged to prevent drainage directly onto paved surfaces.</li> <li>Lot is designed to include semi-permeable hardscape.</li> </ul>	[ ]	[ x ]	[ - ]	① ② ③ ④ ⑤
<b>K. OVER WATER ACTIVITIES</b> BMPs employed:	[ ]	[ x ]	[ - ]	① ② ③ ④ ⑤
<b>L. OTHER (describe):</b>	[ ]	[ x ]	[ - ]	① ② ③ ④ ⑤

\*① No BMPs used and stormwater pollution likely    ② Some BMPs used but not effective  
 ④ Source control BMPs used and very effective/structural BMPs needed

③ Some BMPs used and moderately effective  
 ⑤ All necessary BMPs used and very effective

### 3. TYPE AND QUANTITY OF MATERIALS USED

Material	Typical Quantity/Frequency	Is Stored Material Likely to Generate Pollutants
Gasoline	250 gal/day	yes
Motor oil	90 gal/wk	yes
Detergents	40 lb/wk	no

### 4. HISTORY OF SPILLS AND LEAKS

- a) Is there a chronic history of spills and leaks? no
- b) Is there no evidence of leaks and drips from equipment and machinery? drip pans in place
- c) Is there a spill prevention and response team? yes
- d) Are appropriate spill containment and cleanup materials kept on-site and in convenient locations? materials present, but need to be placed near fueling areas.
- e) Are cleanup procedures for spills followed regularly and correctly? yes
- f) Are used absorbent materials removed and disposed of in a timely manner? stored spill clean up materials observed on-site, proper disposal required.
- g) Are personnel regularly trained in the use of spill control materials? yes

### 5. NON-STORMWATER DISCHARGES

- a) Outfall directly observed during assessment no
- b) Are BMPs implemented to prevent, treat, or control non-stormwater discharges? yes, but could use improvement (see BMP selection recommendations).
- c) Is there a potential for non-stormwater discharges (i.e. non-stormwater sources observed without BMPs implemented) yes, (see BMP selection recommendations)

### 6. SIZE OF FACILITY (incorporating the size of a facility serves as a surrogate measure for flow)

- a) Total area 400,000 square feet.
- b) The impervious area (including parking lot) is 320,000 square feet (80% impervious)

### 7. PROXIMITY TO RECEIVING WATER

Does the facility discharge directly or adjacent to a 303(d) water body or other environmentally sensitive area? no

# **Appendix C**

## **BMP Selection Process**

The purpose of this appendix is to illustrate the process of selecting BMPs for an example fixed facility. Information necessary for this process includes use of the results from the inventory (Appendix A) and assessment (Appendix B) processes.

The BMPs listed in the example checklist below are the required measures to control the discharge of pollutants to the stormwater drainage system for the activities identified during the assessment process (Appendix B). The BMPs listed include both those that were currently being implemented at the site as well as recommended BMPs based on the facility assessment. The BMP fact sheets presented in Section 3 should be used to identify recommended BMPs for municipal operations, however, note that not all BMPs listed in the fact sheets may be applicable to a given facility. You are encouraged to employ additional BMPs if they will control pollutants in an effective manner.





Facility Name: County Yard Site Address: 1200 Pine Rd., Anaheim, CA

Contact Name: Ron Jones Phone: (111) 222-3333

## **APPLICABLE BMPs**

### **A. VEHICLE AND EQUIPMENT FUELING (Fact Sheet SC-20)**

#### Current

- Employees trained in proper fueling and cleanup procedures.
- "Shut-off" valves installed on nozzles.
- "Topping off" of fuel tanks is discouraged.
- Adsorbent materials used on spills as opposed to hosing down.
- Drains labeled within the facility boundary, by stencil to indicate whether they flow to an oil/water separator, directly to the sewer, or to a storm drain.
- Fueling area designed to prevent storm water runoff and spills.
- Fueling area covered with an overhanging roof structure.

#### Recommended

- Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Install covered spill kits next to fueling area.

### **B. VEHICLE AND EQUIPMENT WASHING/STEAM CLEANING (Fact Sheet SC-21)**

#### Current

- Vehicles and equipment are washed at an off-site commercial washing location whenever possible.
- On-site washing area is clearly marked as a wash area.
- Signs are posted stating that only washing is allowed in wash area and that discharges to the storm drain are prohibited.
- Trash containers are provided in wash area.
- A map of on-site storm drain locations exists to avoid discharges to the storm drain system.

#### Recommended

- Use biodegradable, phosphate-free detergents for washing vehicles as appropriate.
- Consider washing vehicle equipment inside the building to control the targeted constituents by directing them to the sanitary sewer.

### **C. VEHICLE AND EQUIPMENT MAINTENANCE AND REPAIR (Fact Sheet SC22)**

#### Current

- Idle equipment is stored under cover.
- Drip pans are used for leaking vehicle/equipment.

<ul style="list-style-type: none"> <li>■ Vehicle maintenance area is designed to prevent storm water pollution (area contains berming and appropriate drainage routing).</li> <li>■ Signs are painted on storm drain inlets to indicate that they are not to receive liquid or solid wastes.</li> <li>■ The work area is covered to limit exposure to the rain.</li> </ul>	<p><u>Recommended</u></p> <ul style="list-style-type: none"> <li>■ Avoid hosing down your work areas; use dry sweeping.</li> <li>■ Post signs at sinks to remind employees not to pour hazardous wastes down drains.</li> <li>■ Clean yard storm drain inlets(s) regularly and especially after large storms.</li> </ul>
D.	OUTDOOR LOADING/UNLOADING OF MATERIALS (Fact Sheet SC-30) N/A
E.	OUTDOOR CONTAINER STORAGE OF LIQUIDS (Fact Sheet SC-31) N/A
F.	OUTDOOR PROCESS EQUIPMENT OPERATIONS AND MAINTENANCE (Fact Sheet SC-32) N/A
G.	<p>OUTDOOR STORAGE OF RAW MATERIALS (Fact Sheet SC-33)</p> <p><u>Current</u></p> <ul style="list-style-type: none"> <li>■ Materials are stored inside when feasible.</li> <li>■ All outside storage areas are covered with a roof or enclosed to prevent stormwater contact.</li> <li>■ Outdoor storage containers are kept in good condition.</li> <li>■ Lids are secured on waste barrels and containers.</li> <li>■ Drums are stored in a secure area where unauthorized persons cannot gain access.</li> </ul> <p><u>Recommended</u></p> <ul style="list-style-type: none"> <li>■ All materials stored outside should have some type of secondary containment system in case of spills or leaks.</li> </ul>
H.	WASTE HANDLING AND DISPOSAL (Fact Sheet SC-34) N/A
I.	BUILDING AND GROUNDS MAINTENANCE (Fact Sheet SC-41) N/A
J.	<p>PARKING/STORAGE AREA MAINTENANCE (Fact Sheet SC-43)</p> <p><u>Current</u></p> <ul style="list-style-type: none"> <li>■ Parking and storage areas are kept clean and orderly.</li> <li>■ Site is designed to allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.</li> <li>■ Rooftop drains are arranged to prevent drainage directly onto paved surfaces.</li> <li>■ Lot is designed to include semi-permeable hardscape.</li> </ul> <p><u>Recommended</u></p> <ul style="list-style-type: none"> <li>■ Remove debris in a timely fashion.</li> <li>■ Utilize sand filters or oleophilic collectors for oily waste in low concentrations.</li> </ul>
K.	OVER WATER ACTIVITIES (Fact Sheet SC-50) N/A
L.	OTHER (describe):

# **Appendix D**

## **Example Contract/Lease Language for BMP Implementation**

## **Appendix D Example Contract/Lease Language for BMP Implementation**

### **Example Lease Language for Fixed Facilities**

Following is example language that can be inserted into municipal leases:

The \_\_\_\_\_ Regional Water Quality Control Board (RWQCB) has issued a permit that governs stormwater and non-stormwater discharges resulting from municipal activities performed by or for the City of \_\_\_\_\_. The RWQCB Permit is National Pollutant Discharge Elimination System (NPDES) Permit No. \_\_\_\_\_. Copy of the RWQCB Permit is available for review.

In order to comply with the Permit requirements, the City has developed Best Management Practices (BMPs) that parties leasing municipal owned properties must adhere to. These BMPs contain pollution prevention and source control techniques to minimize the impact of those activities upon dry-weather urban runoff, stormwater runoff, and receiving water quality.

Activities performed at the facility leased under this agreement shall conform to the Permit and BMPs, and must be performed as described within all applicable BMPs. The holder of this agreement shall fully understand the BMPs applicable to activities conducted at the facility leased under this agreement prior to conducting them and maintain copies of the BMPs at the leased facility throughout the agreement duration. The applicable BMPs are included as Exhibit \_\_\_\_ of this agreement.

Evaluation of activities subject to Permit performed at the facility leased under this agreement will be conducted by the city to verify compliance with BMP requirements and may be required through lessor self-evaluation as determined by the city.

### **Example Contract Language for Field Programs**

Following is example language that can be inserted into municipal field program contracts:

The \_\_\_\_\_ Regional Water Quality Control Boards (RWQCB) has issued a permit that governs stormwater and non-stormwater discharges resulting from areas owned and operated by the City of \_\_\_\_\_. The RWQCB Permit is National Pollutant Discharge Elimination System (NPDES) Permit No. \_\_\_\_\_. Copy of the RWQCB Permit is available for review.

In order to comply with the Permit requirements, the City has developed Best Management Practices (BMPs) that parties conducting the municipal activities must adhere to. These BMPs apply to any party conducting municipal activities and contain pollution prevention and source control techniques to minimize the impact of those activities upon dry-weather urban runoff, stormwater runoff, and receiving water quality.



Work performed under this CONTRACT shall conform to the Permit requirements, and BMPs, and must be performed as described within all applicable BMPs. The CONTRACTOR shall fully understand the BMPs applicable to activities that are being conducted under this CONTRACT prior to conducting them and maintain copies of the BMPs throughout the CONTRACT duration. The applicable BMPs are included as Exhibit \_\_\_\_ of this CONTRACT.

Evaluation of activities subject to BMPs performed under this CONTRACT will be conducted to verify compliance with BMP requirements and may be required through CONTRACTOR self-evaluation as determined by the city.

## APPENDIX E

### ISA BASIS TREE RISK ASSESSMENT FORM

# ISA Basic Tree Risk Assessment Form

Client \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_  
 Address/Tree location \_\_\_\_\_ Tree no. \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_  
 Tree species \_\_\_\_\_ dbh \_\_\_\_\_ Height \_\_\_\_\_ Crown spread dia. \_\_\_\_\_  
 Assessor(s) \_\_\_\_\_ Tools used \_\_\_\_\_ Time frame \_\_\_\_\_

## Target Assessment

Target number	Target description	Target protection	Target zone			Occupancy rate 1-rare 2-occasional 3-frequent 4-constant	Practical to move target?	Restriction practical?
			Target within drip line	Target within 1 x Ht.	Target within 1.5 x Ht.			
1								
2								
3								
4								

## Site Factors

History of failures \_\_\_\_\_ Topography Flat ☐ Slope ☐ \_\_\_\_\_ % Aspect \_\_\_\_\_  
 Site changes None ☐ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe \_\_\_\_\_  
 Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ \_\_\_\_\_ % Describe \_\_\_\_\_  
 Prevailing wind direction \_\_\_\_\_ Common weather Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe \_\_\_\_\_

## Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ Foliage None (seasonal) ☐ None (dead) ☐ Normal \_\_\_\_\_ % Chlorotic \_\_\_\_\_ % Necrotic \_\_\_\_\_ %  
 Pests/Biotic \_\_\_\_\_ Abiotic \_\_\_\_\_  
 Species failure profile Branches ☐ Trunk ☐ Roots ☐ Describe \_\_\_\_\_

## Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☐ Wind funneling ☐ \_\_\_\_\_ Relative crown size Small ☐ Medium ☐ Large ☐  
 Crown density Sparse ☐ Normal ☐ Dense ☐ Interior branches Few ☐ Normal ☐ Dense ☐ Vines/Mistletoe/Moss ☐ \_\_\_\_\_  
 Recent or expected change in load factors \_\_\_\_\_

## Tree Defects and Conditions Affecting the Likelihood of Failure

### — Crown and Branches —

Unbalanced crown ☐ LCR \_\_\_\_\_ %  
 Dead twigs/branches ☐ \_\_\_\_\_ % overall Max. dia. \_\_\_\_\_  
 Broken/Hangers Number \_\_\_\_\_ Max. dia. \_\_\_\_\_  
 Over-extended branches ☐  
 Pruning history  
 Crown cleaned ☐ Thinned ☐ Raised ☐  
 Reduced ☐ Topped ☐ Lion-tailed ☐  
 Flush cuts ☐ Other \_\_\_\_\_  
 Cracks ☐ Lightning damage ☐  
 Codominant ☐ Included bark ☐  
 Weak attachments ☐ Cavity/Nest hole \_\_\_\_\_ % circ.  
 Previous branch failures ☐ Similar branches present ☐  
 Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐  
 Conks ☐ Heartwood decay ☐  
 Response growth \_\_\_\_\_

Condition (s) of concern \_\_\_\_\_

Part Size \_\_\_\_\_ Fall Distance \_\_\_\_\_  
 Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Part Size \_\_\_\_\_ Fall Distance \_\_\_\_\_  
 Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

### — Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐  
 Codominant stems ☐ Included bark ☐ Cracks ☐  
 Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐  
 Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐  
 Cavity/Nest hole \_\_\_\_\_ % circ. Depth \_\_\_\_\_ Poor taper ☐  
 Lean \_\_\_\_\_ ° Corrected? \_\_\_\_\_  
 Response growth \_\_\_\_\_  
 Condition (s) of concern \_\_\_\_\_

Part Size \_\_\_\_\_ Fall Distance \_\_\_\_\_

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

### — Roots and Root Collar —

Collar buried/Not visible ☐ Depth \_\_\_\_\_ Stem girdling ☐  
 Dead ☐ Decay ☐ Conks/Mushrooms ☐  
 Ooze ☐ Cavity ☐ \_\_\_\_\_ % circ.  
 Cracks ☐ Cut/Damaged roots ☐ Distance from trunk \_\_\_\_\_  
 Root plate lifting ☐ Soil weakness ☐

Response growth \_\_\_\_\_

Condition (s) of concern \_\_\_\_\_

Part Size \_\_\_\_\_ Fall Distance \_\_\_\_\_

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

### Risk Categorization

[illegible]

*Matrix I.* Likelihood matrix.

Likelihood of Failure	Likelihood of Impact			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

**Matrix 2. Risk rating matrix.**

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

### Notes, explanations, descriptions

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### Mitigation options

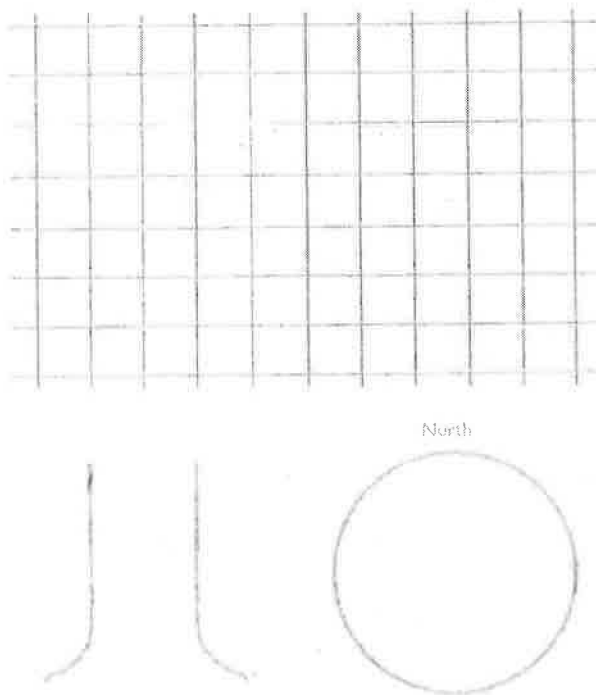
1.		Residual risk
2.		Residual risk
3.		Residual risk
4.		Residual risk

Overall tree risk rating      Low ☐   Moderate ☐   High ☐   Extreme ☐

Overall residual risk    None ☐    Low ☐    Moderate ☐    High ☐    Extreme ☐    Recommended inspection interval \_\_\_\_\_

**Data** ☐ Final ☐ Preliminary **Advanced assessment needed** ☐ No ☐ Yes-Type/Reason \_\_\_\_\_

Inspection limitations ☐None ☐Visibility ☐Access ☐Vines ☐Root collar buried Describe \_\_\_\_\_





APPENDIX F  
BUILDING SPECIAL PROVISIONS

**BULLETIN NO. 1**

**SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO  
PARK RENOVATIONS**

**CITY OF LANCASTER**  
44933 North Fern Avenue  
Lancaster, California 93534

**SPECIFICATIONS**

Prepared by  
**IDS GROUP**  
1 Peters Canyon Road, Suite 130  
Irvine, CA 92606

Public Works Project No. 24-008

Date: March 10, 2025

Division            Section Title

**SPECIFICATIONS GROUP**

***General Requirements Subgroup***

**DIVISION 01 - GENERAL REQUIREMENTS**

01 10 00	SUMMARY
01 23 00	ALTERNATES
01 25 00	SUBSTITUTION PROCEDURES
01 31 00	PROJECT MANAGEMENT AND COORDINATION
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
01 33 00	SUBMITTAL PROCEDURES
01 40 00	QUALITY REQUIREMENTS
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 56 39	TEMPORARY TREE AND PLANT PROTECTION
01 57 23	TEMPORARY STORM WATER POLLUTION CONTROL
01 60 00	PRODUCT REQUIREMENTS
01 73 29	CUTTING AND PATCHING
01 77 00	CLOSEOUT PROCEDURES
01 78 23	OPERATION AND MAINTENANCE DATA

***Facility Construction Subgroup***

**DIVISION 02 - EXISTING CONDITIONS**

02 41 16	STRUCTURE DEMOLITION
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**DIVISION 03 - CONCRETE**

03 30 00	CAST-IN-PLACE CONCRETE
03 33 00	ARCHITECTURAL CONCRETE
03 37 13	SHOTCRETE
03 53 00	CONCRETE TOPPING

**DIVISION 04 - MASONRY**

04 01 10	MASONRY CLEANING
04 22 00	CONCRETE UNIT MASONRY

**DIVISION 05 - METALS**

05 12 00	STRUCTURAL STEEL FRAMING
05 12 13	ARCHITECTURALLY EXPOSED STRUCTURAL STEEL
05 50 00	METAL FABRICATIONS
05 53 13	BAR GRATINGS
05 70 00	DECORATIVE METAL

**DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES**

06 10 00	ROUGH CARPENTRY
06 16 00	SHEATHING
06 20 23	INTERIOR FINISH CARPENTRY
06 41 16	PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
06 64 00	PLASTIC PANELING

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

07 13 26	SELF-ADHERING SHEET WATERPROOFING
07 14 16	COLD FLUID-APPLIED WATERPROOFING
07 19 00	WATER REPELLENTS
07 21 00	THERMAL INSULATION
07 22 00	ROOF AND DECK INSULATION
07 41 13.13	FORMED METAL ROOF PANELS
07 41 13.16	STANDING-SEAM METAL ROOF PANELS
07 46 46	FIBER-CEMENT SIDING
07 92 00	JOINT SEALANTS

**DIVISION 08 - OPENINGS**

08 11 13	HOLLOW METAL DOORS AND FRAMES
08 14 16	FLUSH WOOD DOORS
08 31 13	ACCESS DOORS AND FRAMES
08 41 13	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
08 71 00	DOOR HARDWARE
08 80 00	GLAZING
08 91 19	FIXED LOUVERS

**DIVISION 09 - FINISHES**

09 24 00	CEMENT PLASTERING
09 29 00	GYPSUM BOARD
09 30 13	CERAMIC TILING
09 51 13	ACOUSTICAL PANEL CEILINGS
09 65 13	RESILIENT BASE AND ACCESSORIES
09 65 16	RESILIENT SHEET FLOORING
09 65 19	RESILIENT TILE FLOORING
09 67 23	RESINOUS FLOORING
09 91 13	EXTERIOR PAINTING
09 91 23	INTERIOR PAINTING
09 96 00	HIGH-PERFORMANCE COATINGS

**DIVISION 10 - SPECIALTIES**

10 11 00	VISUAL DISPLAY UNITS
10 14 19	DIMENSIONAL LETTER SIGNAGE
10 14 23	PANEL SIGNAGE
10 14 23.16	ROOM-IDENTIFICATION PANEL SIGNAGE



10 21 13.19	PLASTIC TOILET COMPARTMENTS
10 22 13	WIRE MESH PARTITIONS
10 28 00	TOILET, BATH, AND LAUNDRY ACCESSORIES
10 44 13	FIRE PROTECTION CABINETS
10 44 16	FIRE EXTINGUISHERS
10 75 29	PLAZA-MOUNTED FLAGPOLES

**DIVISION 12 - FURNISHINGS**

12 24 13	ROLLER WINDOW SHADES
12 36 23.13	PLASTIC-LAMINATE-CLAD COUNTERTOPS
12 36 61.16	SOLID SURFACING COUNTERTOPS

**DIVISION 13 - SPECIAL CONSTRUCTION**

13 29 13	SKATEBOARD PARK
13 29 23	SPLASH PAD
13 31 23	PRE-ENGINEERED FABRIC SHADE STRUCTURES

***Facility Services Subgroup***

**DIVISION 22 - PLUMBING**

22 05 00	COMMON WORK RESULTS FOR PLUMBING
22 05 14	COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
22 05 17	SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
22 05 19	METERS AND GAGES FOR PLUMBING PIPING
22 05 23	GENERAL-DUTY VALVES FOR PLUMBING PIPING
22 05 29	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
22 05 48	VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT
22 05 53	IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
22 07 19	PLUMBING PIPING INSULATION
22 08 00	COMMISSIONING OF PLUMBING SYSTEMS
22 11 16	DOMESTIC WATER PIPING
22 11 19	DOMESTIC WATER PIPING SPECIALTIES
22 11 26	DOMESTIC-WATER PACKAGED BOOSTER PUMPS
22 13 16	SANITARY WASTE AND VENT PIPING
22 13 19	SANITARY WASTE PIPING SPECIALTIES
22 14 13	FACILITY STORM DRAINAGE PIPING
22 14 23	STORM DRAINAGE PIPING SPECIALTIES
22 40 00	PLUMBING FIXTURES
22 42 13.13	COMMERCIAL WATER CLOSETS
22 42 13.16	COMMERCIAL URINALS
22 42 16.13	COMMERCIAL LAVATORIES
22 42 16.16	COMMERCIAL SINKS

**DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 13	DUCT INSULATION
23 07 19	HVAC PIPING INSULATION
23 09 00	INSTRUMENTATION AND CONTROL FOR HVAC
23 23 00	REFRIGERANT PIPING
23 31 13	METAL DUCTS
23 34 23	HVAC POWER VENTILATORS
23 37 13	DIFFUSERS, REGISTERS, AND GRILLES
23 81 26	SPLIT-SYSTEM AIR-CONDITIONING HEAT PUMP UNITS

***Site and Infrastructure Subgroup***

**DIVISION 31 - EARTHWORK**

03 11 000	SITE CLEARING
31 20 00	EARTH MOVING
31 50 00	EXCAVATION SUPPORT AND PROTECTION

**DIVISION 32 - EXTERIOR IMPROVEMENTS**

32 12 16	ASPHALT PAVING
32 13 13	CONCRETE PAVING
32 13 16	DECORATIVE CONCRETE PAVING
32 13 73	CONCRETE PAVING JOINT SEALANTS
32 14 40.13	DECORATIVE STONE SURFACING
32 17 13	PARKING BUMPERS
32 17 23	PAVEMENT MARKINGS
32 17 26	TACTILE WARNING SURFACING
32 33 00	SITE FURNISHINGS
32 84 00	PLANTING IRRIGATION
32 91 13	SOIL PREPARATION
32 93 00	PLANTS

**DIVISION 33 - UTILITIES**

33 05 00	COMMON WORK RESULTS FOR UTILITIES
33 14 15	SITE WATER DISTRIBUTION PIPING
33 42 00	STORMWATER CONVEYANCE
33 46 00	SUBDRAINAGE

END OF TABLE OF CONTENTS

## SECTION 01 10 00 - SUMMARY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Coordination of Owner's Portion of the Work.
4. Work restrictions.

#### 1.2 PROJECT INFORMATION

A. Project Identification: City of Lancaster Public Works Construction Project No. 24-008, Samaritan Purse Park Renovations.

1. Project Location: 44501 5<sup>th</sup> Street East, Lancaster, California 93534.

B. Owner: City of Lancaster Public Works (City), 44933 North Fern Avenue, Lancaster, CA 93534.

1. Owner's Representative: Frank Lujan, Engineer – PW City Engineering. Tel: (661) 723-6225. Email: flujan@cityoflanasterca.gov.

C. Architect: IDS Group, Inc., 1 Peters Canyon Road, Suite 130, Irvine, California 92606.

1. Architect's Representative: Matthew M. Miller, Project Manager. Tel: (949) 387-8500, ext. 142.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Civil Engineer: IDS Group, Inc., 1 Peters Canyon Road, Suite 130, Irvine, California 92606.

- a. Civil Engineer's Representative: Adrian Anderson. Tel: (949) 387-8500, ext 509.

2. Structural Engineer: IDS Group, Inc., 1 Peters Canyon Road, Suite 130, Irvine, California 92606.

- a. Structural Engineer's Representative: Said Hilmy. Tel: (949) 387-8500, ext 113.

3. Mechanical Engineer: IDS Group, Inc., 1 Peters Canyon Road, Suite 130, Irvine, California 92606.
  - a. Mechanical Engineer's Representative: Darren Smith. Tel: (949) 387-8500, ext 454.
4. Plumbing Engineer: IDS Group, Inc., 1 Peters Canyon Road, Suite 130, Irvine, California 92606.
  - a. Plumbing Engineer's Representative: Darren Smith. Tel: (949) 387-8500, ext 454.
5. Electrical Engineer: IDS Group, Inc., 1 Peters Canyon Road, Suite 130, Irvine, California 92606.
  - a. Electrical Engineer's Representative: Steven Collins. Tel: (949) 387-8500, ext 325.

### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
  1. Renovation of the existing 7.2 acre Samaritan's Purse Park (formally El Dorado Park) and renovations to existing Community Center building, recreational features, and upgrades to the existing park including new landscaping and vegetation, providing ADA access to pathways, sidewalks, exercise equipment, and recreational areas. The project's park features will include the following:
    - a. Renovation of the existing Community Center Building.
    - b. ADA accessible walking/jogging pathways with eleven (11) exercise equipment stations.
    - c. Half-court basketball court.
    - d. Splash pad area.
    - e. Skateboard area.
    - f. New landscaping and vegetation.
    - g. Plaza area with seating/benches and park furniture with overhead shade sails structures.
    - h. New concrete with new landscaped edge at patio.
    - i. New metal canopy in the patio.
    - j. New mechanical pad.
    - k. New trash enclosure.
- B. Type of Contract: Public Bid-Build
  1. Project will be constructed under a single prime contract.



#### 1.4 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: Each Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by City's right to perform work or to retain other contractors on portions of Project.
  - 1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to City, City's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

#### 1.5 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for City's playground equipment vendor(s) and installation crews.
- B. Provide temporary staging area(s) on-site for City's playground equipment vendor's use.
- C. Coordination: Coordinate construction and operations of the Work with work performed by City's playground equipment vendor(s).
- D. Construction Schedule: Inform Architect and City of Contractor's preferred construction schedule for playground equipment delivery, staging and installation. Adjust construction schedule based on a mutually agreeable timetable. Notify City if changes to schedule are required due to differences in actual construction progress.
- E. Preinstallation Conferences: Include City's playground equipment vendor(s) at preinstallation conferences covering preparation of playground surface and underground utilities within playground area(s). Discuss delivery, handling, storage, assembly and installation of playground equipment and any other City's separate contractor's or vendor's Work.

#### 1.6 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to between 7:00 a.m. to 3:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by City and authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

## SECTION 01 23 00 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.
- B. See "Schedule of Alternates" at end of this Section for description of alternates.

#### 1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to the base bid amount if the City decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement and included in City's Bid Proposal form.
  - 2. The cost for each alternate is the net addition to the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

#### 1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Additive Alternate No. 1 (AA1): North Park.

1. Base Bid: Provide underground electrical conduits with pull string from the Skate Park's North light pole to the existing North Park Parking Lot first Light Pole low voltage cameras, as indicated on Drawings.
2. Add Alternate 1: North Park & Parking Lot.
  - a. Provide new accessible path of travel at east side of existing parking lot from City sidewalk at 5th Avenue to North Park Trail.
  - b. Provide new accessible path of travel from Foxton Avenue to North Park Trail.
  - c. Provide accessible ramp and pathway from existing ADA parking stalls at northwest corner of existing parking lot.
  - d. Stabilize decomposed granite pathway.
  - e. Provide pathway concrete edging.
  - f. Provide (11) Fitness Equipment Safety Surfaces.
  - g. Provide (11) Fitness Equipment Stations (including posts).
  - h. Remove (13) existing light poles at North Park Trail.
  - i. Provide trenching for new underground conduit & wiring.
  - j. Provide (6) new light poles at Parking Lot per Electrical Drawings.
  - k. Provide (24) new light poles along North Park Trail per Electrical Drawings.
  - l. Provide (1) drinking fountain at North Park Trail per Landscape Drawings.
  - m. Weather track controller & Flow Meter.
  - n. Spray Heads.
  - o. Tree Protection (80).
  - p. Misc. Site Furniture (Bike Racks).

B. Additive Alternate No. 2 (AA2): Basketball Court Lighting.

1. Base Bid: Construct Basketball Court without lighting fixtures.
  - a. Basketball court concrete pad clearing and grading.
  - b. Basketball Court concrete pad, concrete finishing, curing, and basketball court striping.
  - c. Basketball Backstop & Hoop attached to galvanized steel pipe, with concrete foundations.
2. Additive Alternate 2: Basketball lighting fixtures.
  - a. Provide exterior lighting fixtures at basketball court, complete with foundations, terminal wiring and integrated lighting controls as indicated on Drawings.

END OF SECTION 01 23 00



## SECTION 01 25 00 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or City that are not required to meet other Project requirements but may offer advantage to Contractor or City.

#### 1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
- B. product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form acceptable to Architect.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by City and separate contractors that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Installation procedures.
  - f. Samples, where applicable or requested.
  - g. Certificates and qualification data, where applicable or requested.
  - h. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and Citys.
  - i. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - j. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - k. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - l. Cost information, including a proposal of change, if any, in the Contract Sum.
  - m. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - n. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven working days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 working days of receipt of request, or seven working days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

#### 1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

#### 1.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

#### 1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 working days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Substitution request is fully documented and properly submitted.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 40 working days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied,

Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution offers City a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities City must assume. City's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by City, and similar considerations.
- b. Requested substitution does not require extensive revisions to the Contract Documents.
- c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
- d. Substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00



## SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. RFIs.
  - 3. Digital project management procedures.
  - 4. Project meetings.
- B. Related Requirements:
  - 1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.2 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from City, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.3 INFORMATIONAL SUBMITTALS

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

#### 1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination of Work: It shall be the responsibility of the Contractor to maintain overall coordination of the work. Based on the general contract construction schedule prepared in accordance with these Specifications, the Contractor shall obtain from each subcontractor a similar schedule and shall be responsible for all parties maintaining these schedules or for coordinating changes necessitated in order to meet the specified time of completion of the work. Contractor shall coordinate with all third party contractors to accommodate the complete installation of third party systems and equipment as well as maintaining the overall project schedule.
  - 1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for City and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Preinstallation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.

#### 1.5 MEASUREMENT AND PAYMENT

- A. Full compensation for conforming to the provisions of this article shall be included in the contract items for which the work relates with no additional compensation allowed therefore.

## 1.6 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  - 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
  - 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. City name.
  - 3. City's Project number.
  - 4. Name of Architect.
  - 5. Architect's Project number.
  - 6. Date.
  - 7. Name of Contractor.
  - 8. RFI number, numbered sequentially.
  - 9. RFI subject.
  - 10. Specification Section number and title and related paragraphs, as appropriate.
  - 11. Drawing number and detail references, as appropriate.
  - 12. Field dimensions and conditions, as appropriate.
  - 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 14. Contractor's signature.
  - 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716, or similar RFI form acceptable to Architect.
  - 1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
  - 1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.

- b. Requests for approval of substitutions.
      - c. Requests for approval of Contractor's means and methods.
      - d. Requests for coordination information already indicated in the Contract Documents.
      - e. Requests for adjustments in the Contract Time or the Contract Sum.
      - f. Requests for interpretation of Architect's actions on submittals.
      - g. Incomplete RFIs or inaccurately prepared RFIs.
    2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
      - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 working days of receipt of the RFI response.
  - E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
    1. Project name.
    2. Name and address of Contractor.
    3. Name and address of Architect.
    4. RFI number, including RFIs that were returned without action or withdrawn.
    5. RFI description.
    6. Date the RFI was submitted.
    7. Date Architect's response was received.
    8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  - F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 working days if Contractor disagrees with response.
- 1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Architect's Data Files Not Available: Architect will not provide Architect's CAD drawing digital data files for Contractor's use during construction.
  - B. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
    1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.



2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in [REDACTED].
4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement, or other licensing agreement form acceptable to City and Architect.
  - a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement, or other licensing agreement form acceptable to City and Architect.

## 1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify City and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including City and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to City and Architect, but no later than 15 days after execution of the Agreement.
  1. Attendees: Authorized representatives of City Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
    - a. All subcontractors are required to attend a preconstruction conference for their particular work prior to beginning work on the project, unless otherwise waived by the Engineer.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.

- f. Lines of communications.
  - g. Use of web-based Project software.
  - h. Procedures for processing field decisions and Change Orders.
  - i. Procedures for RFIs.
  - j. Procedures for testing and inspecting.
  - k. Procedures for processing Applications for Payment.
  - l. Distribution of the Contract Documents.
  - m. Submittal procedures.
  - n. Sustainable design requirements.
  - o. Preparation of Record Documents.
  - p. Use of the premises and existing building.
  - q. Work restrictions.
  - r. Working hours.
  - s. City's occupancy requirements.
  - t. Responsibility for temporary facilities and controls.
  - u. Procedures for moisture and mold control.
  - v. Procedures for disruptions and shutdowns.
  - w. Construction waste management and recycling.
  - x. Parking availability.
  - y. Office, work, and storage areas.
  - z. Equipment deliveries and priorities.
  - aa. First aid.
  - bb. Security.
  - cc. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to City and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  - 2. Attendees: Authorized representatives of City, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for completing sustainable design documentation.

- f. Requirements for preparing operations and maintenance data.
  - g. Requirements for delivery of material samples, attic stock, and spare parts.
  - h. Requirements for demonstration and training.
  - i. Preparation of Contractor's punch list.
  - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - k. Submittal procedures.
  - l. Coordination of separate contracts.
  - m. City's partial occupancy requirements.
  - n. Installation of City's furniture, fixtures, and equipment.
  - o. Responsibility for removing temporary facilities and controls.
- 4. Minutes: Record and distribute meeting minutes.
- D. Progress Meetings: Conduct progress meetings at weekly intervals.
  - 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of City and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site use.
      - 8) Temporary facilities and controls.
      - 9) Progress cleaning.

- 10) Quality and work standards.
  - 11) Status of correction of deficient items.
  - 12) Field observations.
  - 13) Status of RFIs.
  - 14) Status of Proposal Requests.
  - 15) Pending changes.
  - 16) Status of Change Orders.
  - 17) Pending claims and disputes.
  - 18) Documentation of information for payment requests.
4. Minutes: Record and distribute the meeting minutes to each party present and to parties requiring information.
    - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00



## SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Work under this section shall consist of furnishing a computerized time scaled, Critical Path Method (CPM) Construction Schedule showing in detail how the Contractor plans to execute and coordinate the Work, schedule updating, schedule revisions, and time impact analyses specific to the full prosecution of work under each bid package/contract for which he is responsible.

#### 1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either City or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file.
  - 2. PDF file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports to contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
  - 3. Total Float Report: List of activities sorted in ascending order of total float.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit daily.
- F. Qualification Data: For scheduling consultant.

### 1.4 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of City's or Architect's request.

### 1.5 SCHEDULE REQUIREMENTS

- A. The Contractor shall provide all information required for development of the Construction Schedule in accordance with the requirements of this Section. The purpose of the Construction Schedule shall be to:
  - 1. Assure adequate planning, scheduling, and reporting of all activities by all parties related to the execution of the Work by the Contractor for the duration of the Project.

2. Assure coordination of the Work by the Contractor and the various Subcontractors at all tiers and all other parties attendant to the successful execution of the Work.
  3. Assist the Contractor and the City in monitoring the progress of the Work and evaluating proposed changes to the Contract and the Construction Schedule.
  4. Assist the City and the Contractor in the preparation and evaluation of the Contractor's monthly progress payments.
- B. The Construction Schedule shall employ the Critical Path Method (CPM) using the barchart method for the planning, scheduling, and reporting of the Work to be performed. Any variation from the approach specified herein may be used only with the prior approval of the City.
- C. The Contractor shall provide, at no cost to the City, the automated processing of the computer-produced schedule. All schedule submittals shall be accompanied by an electronic format of the schedule in the form of a computer diskette or CD. The electronic format shall be that generated by the scheduling system (Primavera PRX, SureTrak STX, Microsoft Project MPP), and a PDF copy of the schedule. In addition, a compressed e-mail back up of the schedule file may be transmitted to allow a more expeditious review of the schedule by the City; however, this does not negate the requirement for the specified electronic format.
- D. The Construction Schedule requirements will be discussed at the Pre-construction meeting to assure the City of the Contractor's understanding of the requirements of this Article.
- E. Early Completion:
1. Contract shall be based on the specified contract period established in the project documents. Submit initial schedule as specified showing the contract start date and contract completion date based on the time of performance.
  2. Contractor may prepare a separate schedule based on an early completion date for the project, subject to the following requirements:
    - a. The City is under no obligation to consider early completion.
    - b. The contract completion date shall not be amended by the City's acceptance of Contractor's proposed earlier completion date.
    - c. Contractor shall not under any circumstances, received additional compensation
    - d. from the City for indirect, general, administrative, or other forms of overhead costs, for the period between the time of earlier completion proposed by the Contractor and the official completion date.
    - e. The City shall not be under any obligation to consider any time extension request unless the requirements of the contract documents are complied with, including criteria specified in this section.
    - f. If Contractor proposes an early completion schedule, such schedule shall represent a realistic appraisal of all aspects of the project, including requirements specified in this section.

## 1.6 CONTRACTOR'S REPRESENTATIVE

- A. The Contractor shall advise the City of the authorized representative who shall be responsible for coordinating with the City during the preparation and maintenance of the Construction Schedule. This notification must be made at the Pre-construction meeting, and a resume of the proposed individual must be submitted and accepted by the City prior to the start of construction.
- B. The Contractor's representative shall have complete authority to act on behalf of the Contractor in fulfilling the Construction Schedule requirements, and such authority shall not be interrupted during the Contract, unless approved by the City.
- C. The Contractor shall employ the services of at least one person fully qualified in critical path scheduling for the duration of the Project on projects of similar size and complexity. Any variation from the approach specified herein may be used only with the prior approval of the City. The construction scheduling requirements are to be performed in order to provide the Contractor and the City with the necessary scheduling services to mitigate any impacts, delays, or disruptions by developing work-around schedules and/or recovery schedules as may be necessary. This service will provide both the Contractor and the City with the tools necessary to make informed decisions as the job progresses.
- D. The Contractor's representative shall be available during normal business hours, throughout the entire construction duration.

## 1.7 CPM CONSTRUCTION (BASELINE) SCHEDULE

- A. Submit four (4) copies of CPM Construction (Baseline) Schedule to the City a minimum of seven (7) calendar days prior to Pre-Construction meeting. The schedule shall cover the entire Contract time and shall be neatly organized and be displayed on a time scale from left to right on legal size or larger size sheets. The schedule shall align with the project "for bidding purposes only" schedule issued by City at time of bids. The Contractor's schedule shall consist of, but is not limited to, the following:
  - 1. Mobilization.
  - 2. Construction and temporary facilities.
  - 3. Procurement activities including: shop drawings and sample submittals, approval, and realistic fabrication/delivery dates of key and long-lead procurement elements, and all deferred approval items.
  - 4. Start-up and testing activities.
  - 5. Contractor's pre-punch, City's Punch List and Punch List correction activities by building, floor and areas of the sitework.
- B. The following shall be depicted on the schedule for each activity:
  - 1. Activity ID numbers - the Contractor shall utilize either numeric or alphanumeric designations to identify each and every activity.



2. Description – a clear concise description of the Work represented by the activity.
  3. Original duration, with a maximum duration of twenty (20) days each, except for non-construction activities, including mobilization, shop drawing and sample submittals, and fabrication/delivery of materials and equipment.
  4. Remaining duration.
  5. Percent complete.
  6. Responsibility code.
  7. Early Start or Actual Start date.
  8. Early Finish or Actual Finish date.
  9. Total Float.
- C. The following items are required to be included in the scheduling system, and although are not required to be printed on the schedule, must be available to the City on the electronic format of the schedule.
1. A location code referencing the building and/or floor numbers, site preparation, underground installations, site finishes, etc. to be used for the grouping (banding) of the schedule activities.
- D. There may be only one critical path for the Project on the baseline schedule.
- E. In developing the schedule, the Contractor shall be responsible for assuring the Subcontractor Work at all tiers, as well as its own Work, is included in the schedule. The Contractor shall also be responsible for identifying all activities by other parties, including any utility companies, other prime contractors and the City, which may impact upon the Work.
- F. The schedule as developed shall show the sequence and interdependence of all activities (Contractor and others) required for complete performance of the Work. The Contractor shall be responsible for assuring all work sequences are logical and that the schedule shows a coordinated plan of Work. The building, area, floor, sitework (on site and off site) and site finishes shall include activities for Contractor pre-punch, City Punch List and Punch List corrections. Additionally, all testing shall appear on the Construction Schedule for HVAC equipment start-up, test & balance, systems testing and integrated testing, if applicable to the scope of work.
- G. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity.
- H. Contractor's failure to include any element of Work in the Construction Schedule required for performance of the Contract shall not excuse the Contractor from completing all Work within the Contract Time or cause any extension of time thereof.
- I. If the City questions the Contractor's proposed activities, logic or durations, the Contractor shall, within fourteen (14) calendar days of receipt of the City's request, provide a satisfactory revision to, or adequate justification for, the activities, logic, durations or cost loading to the satisfaction of the City.

- J. In the event the Contractor fails to define any element of Work, activity, or logic and the City's review does not detect this omission or error, such omission or error, when discovered by the Contractor or City, shall be corrected by the Contractor at the next monthly schedule update and shall not be the basis of adjusting the Contract Time.
- K. Acceptance by the City of the Contractor's approved Construction Schedule will be a condition precedent to the making of any progress payments under the Contract except for bonding, insurance and mobilization, which may be permitted at the City's discretion.
  - 1. Acceptance of the Contractor's construction schedule by the City does not relieve the Contractor of any of its responsibility whatsoever for the accuracy of feasibility of the construction schedule, or of the Contractor's ability to meet the contract completion date, nor does such acceptance expressly or impliedly warrant, acknowledge, or admit the reasonableness of the activities, logic, durations, or cost-loading of the Contractor's construction schedule.

#### 1.8 CONSTRUCTION SCHEDULE UPDATING

- A. The Construction Schedule shall be updated on a monthly basis throughout the entire Contract Time. The Contractor shall meet with the City each month at a schedule update meeting to review actual progress made through the data date of the schedule, including the dates that activities started or finished, the percentage of work completed and remaining duration for each activity in progress.
- B. In case of disagreements at the schedule update meeting concerning actual progress to date, the City's determination shall govern.
- C. Upon completion of the schedule update meeting, the Contractor, based upon the City's input, will correct the Construction Schedule to reflect progress as of the date of the schedule update and any agreed-upon changes to the Construction Schedule.
- D. Each Construction Schedule update shall be forwarded to the City's and will include four (4) copies of the following:
  - 1. Prints of the updated schedule indicating the progress made up to the date of the schedule update and indicating any revisions to the schedule.
  - 2. The computer-produced schedule update shall include the same information, and be prepared in the same format, as described under article 1.04 Baseline Schedule.
  - 3. A narrative report is required with the schedule update submittals to define problem areas, anticipated delays and any impact on the Construction Schedule. The report shall also identify any corrective action taken, or proposed actions to be taken, and the effect of that action on the schedule.
- E. The monthly updating of the Construction Schedule shall be an integral part and basic element of the estimate upon which progress payments will be made. If, in the

judgment of the City, the Contractor fails or refuses to provide information required to accomplish a complete Construction Schedule update or revision as specified hereinafter, the Contractor shall be deemed to have not provided the required estimate upon which progress payment may be made, and shall not be entitled to progress payments until it has furnished the information necessary for a complete schedule update to the satisfaction of the City.

- F. At each weekly meeting, Contractor shall prepare a four-week rolling Construction Schedule referencing the CPM schedule activities, and shall show one (1) week of actual and three (3) weeks of forecasted progress. The schedule shall be used as a basis for discussing progress and Work planned during the following three (3) weeks.

#### 1.9 CONSTRUCTION SCHEDULE REVISION

- A. Updating the Construction Schedule to reflect actual progress made up to the date of a schedule update shall not be considered revisions to the Construction Schedule.
- B. If, as a result of the monthly schedule update, it appears the Construction Schedule no longer represents the actual prosecution and progress of the Work, the City will request, and the Contractor shall submit, a revision to the Construction Schedule.
- C. The City may also request revisions to the Construction Schedule in the event the Contractor's planning for the Work is revised. If the Contractor desires to make changes in the Construction Schedule to reflect revisions in its method of operating and scheduling of the Work, the Contractor shall describe the revision(s) in its narrative report stating the reason for the proposed revision.
- D. All reasonable requests by the City for revisions shall be implemented by the Contractor.

#### 1.10 TIME IMPACT ANALYSIS FOR BULLETINS, CHANGE ORDERS, DELAYS AND CONTRACTOR REQUESTS

- A. When Change Orders (including Bulletins or Proposed Change Orders) are initiated, delays are experienced, or the Contractor, in accordance with Article 1.06, desires to revise the Construction Schedule, the Contractor shall submit to the City a written narrative Time Impact Analysis illustrating the influence of each Change Order, delay, or Contractor request on the current Contract completion date. Such Time Impact Analysis shall clearly and completely show all activities, means, methods, and measures proposed by the Contractor to recover the original schedule such that the work is completed by the original Contract completion date, or as near to the original Contract completion date as is reasonable and feasible.
- B. Each narrative Time Impact Analysis shall include a Fragmentary Network (Fragnet) demonstrating how the Contractor proposes to incorporate the Bulletin, Change Order, delay, or Contractor request into the Construction Schedule. The narrative Time Impact

Analysis shall demonstrate the time impact based on the date the Change Order (including a Bulletin or Proposed Change Order) is given to the Contractor or the date the delay occurred, the status of construction at that point in time, and the event time computation of all affected activities. The event times used in the Time Impact Analysis shall be those included in the latest accepted Construction Schedule update or as adjusted by mutual agreement.

- C. Activity delays shall not automatically mean that an extension of the Contract Time is warranted or due the Contractor. It is possible that a Change Order or delay will not affect existing critical activities or cause non-critical activities to become critical. A Change Order or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the network schedule, thereby not causing any effect on the Contract completion date.
- D. Float is not for the exclusive use or benefit of either the City or the Contractor. Contract Time extensions will be granted only to the extent the equitable time adjustments to the activity or activities affected by the Change Order or delay exceeds the total float of a critical activity (or path of activities) and extends the Contract completion date.
- E. Four (4) copies of each narrative Time Impact Analysis shall be submitted within seven (7) calendar days after the commencement of a delay or the notice of direction for a Change Order (including a Proposed Change Order) is given to the Contractor.
- F. ) is given to the Contractor.
- G. In cases where the Contractor does not submit a Time Impact Analysis within (14) calendar days, it is mutually agreed that the particular Change Order (including a Proposed Change Order), delay, or Contractor request does not require a Contract Time extension.
- H. Approval or rejection of each Time Impact Analysis by the City shall be made within seven (7) calendar days after receipt of the Time Impact Analysis unless subsequent meetings and negotiations are necessary.
- I. Time Impact Analysis related to Contract Time extension and/or Change Order Work shall be incorporated into and attached to the applicable Change Order(s).
- J. No extended overhead, general condition money, impact costs, out-of-sequence money, or any other type of compensation, by any name or characterization, shall be paid to the Contractor for delay to any activity not designated as a critical path item on the latest accepted Construction Schedule. If any delay occurs to any critical path item, such compensation shall only be payable to the Contractor in accordance with the terms and provisions of this Section (01320) and of the General Conditions.



#### 1.11 RESPONSIBILITY FOR COMPLETION

- A. The Contractor shall furnish sufficient forces, offices, facilities, and equipment, and shall work such hours including night shift and overtime operations, as necessary to ensure the prosecution of the Work in accordance with the current monthly Construction Schedule update. If, in the opinion of the City, the Contractor falls behind in meeting the Construction Schedule as presented in the current monthly schedule update, the Contractor shall take such steps as may be necessary to improve its progress, and the City may require it to increase the hours of work, the number of shifts, overtime operations, and/or the amount of construction plant and equipment without additional cost to the City. The provisions of this paragraph shall not be construed as prohibiting Work on Saturdays, Sundays and holidays, if the Contractor so elects and gives advanced notice as required by the Contract documents.
- B. Failure of the Contractor to comply with the requirements of this subsection shall be a basis for determination by the City that the Contractor is not prosecuting the work with such diligence as will ensure completion within the Contract Time. Upon such determination, the City may terminate the Contractor's right to proceed with the Work or any separable part thereof, in accordance with the provisions of the General Conditions, or may take such other actions as may be deemed appropriate.

#### 1.12 PERFORMANCE MONITORING

- A. The City may elect throughout or at any time during the Project to record the number of workers and construction equipment working on each schedule activity in each area of the Project and give a copy of this log to the Contractor who shall be responsible for advising the City, without additional cost to the City, of any error in this work history, in writing, within seven (7) calendar days of receipt of same. This information will be used by the City in its evaluation of the adequacy of the Contractor's performance and on-site manpower staffing, as well as in the evaluation of any Contractor claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
5. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.

#### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### 1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. cation.
4. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
  - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
5. Format: Arrange the following information in a tabular format:
  - a. Scheduled date for first submittal.
  - b. Specification Section number and title.
  - c. Submittal Category: Action; informational.
  - d. Name of subcontractor.
  - e. Description of the Work covered.
  - f. Scheduled date for Architect's final release or approval.
  - g. Scheduled dates for purchasing.
  - h. Scheduled date of fabrication.
  - i. Scheduled dates for installation.
  - j. Activity or event number.

#### 1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.

15. Remarks.
16. Signature of transmitter.

- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Paper Submittals: Not required.
- E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- F. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

## 1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
    - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
  2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.



4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 15 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 working days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, City, or other parties is indicated, allow 21 working days for initial review of each submittal.
  5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 working days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
    - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## 1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.

- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
  2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.
  3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
  4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
  5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as City's property, are the property of Contractor.
  6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit two (2) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected.
  8. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

- 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
  - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Architect, project location, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
  2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
  5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
  6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record



of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - a. Name of evaluation organization.
  - b. Date of evaluation.
  - c. Time period when report is in effect.
  - d. Product and manufacturers' names.
  - e. Description of product.
  - f. Test procedures and results.
  - g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file, with stamp and seal of the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

#### 1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

#### 1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
  - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:
    - a. Insert description of each action indicated on Architect's stamp.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will discard submittals received from sources other than Contractor.

- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

## SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, City, or authorities having jurisdiction are not limited by provisions of this Section.

#### 1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of three previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
  - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
  - 1. Mockups are used for one or more of the following:
    - a. Verify selections made under Sample submittals.
    - b. Demonstrate aesthetic effects.



- c. Demonstrate the qualities of products and workmanship.
    - d. Demonstrate successful installation of interfaces between components and systems.
    - e. Perform preconstruction testing to determine system performance.
  - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
  - 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.
- 1.3 DELEGATED DESIGN SERVICES
- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to

Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

#### 1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

#### 1.5 ACTION SUBMITTALS

- A. Mockup Shop Drawings:
  - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
  - 2. Indicate manufacturer and model number of individual components.
  - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data:
  - 1. For Contractor's quality-control personnel.
  - 2. For special inspectors.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.

2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  1. Specification Section number and title.
  2. Entity responsible for performing tests and inspections.
  3. Description of test and inspection.
  4. Identification of applicable standards.
  5. Identification of test and inspection methods.
  6. Number of tests and inspections required.
  7. Time schedule or time span for tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For City's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

## 1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate City's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  1. Project quality-control manager does not have other Project responsibilities.
  2. Experience performing, managing or administration of Quality-Control procedures on past or present Public Works Construction Projects is preferred, but not mandatory.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
  - 3. City-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, telephone number, and email address of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
  - 1. Name, address, telephone number, and email address of technical representative making report.



2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement of whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement of whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.

## 1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
  - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor's Responsibilities:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
    - e. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
  - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups of size indicated.

2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
  - a. Allow seven days for initial review and each re-review of each mockup.
7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

#### 1.10 QUALITY CONTROL

- A. City Responsibilities: Where quality-control services are indicated as City's responsibility, City will engage a qualified testing agency to perform these services.
  1. City will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to City are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
  1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Engage a qualified testing agency to perform quality-control services.
    - a. Contractor will not employ same entity engaged by City, unless agreed to in writing by City.
  3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspection will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
  - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspection equipment at Project site.



- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents as a component of Contractor's quality control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with Application for Payment.

#### 1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing laboratory, and special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Contractor, as indicated in the Statement of Special Inspections attached to this Section, and as follows:
  - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  - 2. Notifying Architect and City promptly of irregularities and deficiencies observed in the Work during performance of its services.
  - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to City and to authorities having jurisdiction.
  - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  - 5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
  - 6. Retesting and reinspecting corrected Work.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

##### 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.

- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
  - 1. Submit log at Project closeout as part of Project Record Documents.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 29 "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

## SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Construction Facilities: All construction hoists, cranes, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and/or move the loads to which they will be subjected. All railings, enclosures, safety devices, traffic and other controls required by law or for adequate protection of life and property shall be provided.
- B. Staging and Shoring: All temporary supports shall be designed with an adequate safety factor to assure adequate load bearing capability. If requested by the City, the Contractor shall provide design calculations, prepared by a Registered Civil Engineer, for staging and/or shoring before construction loads are imposed on it.
- C. Temporary Enclosures: At any time joint welding, or other activities inconveniencing or dangerous to property or the health of employees or the public are in progress the area of activity, shall be enclosed adequately to contain the dust, debris, or other hazard. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate the Contractor shall provide temporary enclosures acceptable to the City.
- D. Warning Devices and Barricades: The Contractor shall adequately identify and guard all hazardous areas and conditions by visual warning devices and, where necessary, physical barriers. Such devices shall, as a minimum, conform to the requirements of the Occupational Safety and Health Administration.
- E. Hazards in Protected Areas: Excavations on project sites from which the public is excluded shall be marked or guarded in a manner appropriate for the hazard.
- F. Protection of Existing Items: The Contractor shall protect all existing structures, trees, shrubs, and other items on the project site that are to be preserved, by substantial barricades or other devices commensurate with the hazard, from injury or destruction by vehicles, equipment, workmen, or other agents.
- G. Project Security: The Contractor shall make adequate provision, subject to the approval of the City, to protect the project and Contractor's facilities from fire, theft, and vandalism, and the public from unnecessary exposure to injury.
- H. Fire Extinguisher: At least one (1) fire extinguisher, rated at least 2A, shall be provided in or readily accessible to each temporary office or storage structure on the jobsite.

- I. Temporary Fences: Temporary fencing shall be required for this project. This shall not relieve the Contractor of the responsibility of properly securing the construction site and material thereon.
  - 1. Around the construction site, erect fences and barricades with gates, as required by local governing authorities, for security and to prevent unauthorized entry to the Work site. Maintain in good condition until completion of the Project.
- J. Special Controls: The Contractor shall take all reasonable means to minimize inconvenience and injury to the public by dust, noise, diversion of storm or stream water, or other agencies under his control.
- K. Dust Control: The Contractor shall take whatever steps, procedures, or means as are required to prevent abnormal dust conditions being caused by his operations in connection with this Contract; and on any unpaved road which the Contractor or any of his subcontractors are using, excavation or fill areas, demolition operation, or other activities. Control shall be by sprinkling, use of dust palliative, modification of operations, or any other means acceptable to the City and the Health or Environmental Control Agency having jurisdiction.
- L. Drainage Control: In excavation, fill, and grading operations care shall be taken to disturb the pre-existing drainage pattern as little as possible.
- M. Temporary Construction Office: Provide and maintain, for the duration of the Contract, a project office, complete with heat, light, ventilation and convenience outlets. The office shall be of sufficient size for the Contractor's personnel and operators and shall provide desk space for use by the Architect and for inspection personnel.
- N. Temporary Toilets: Provide temporary toilet facilities for all personnel employed on the Project. Maintain toilets in a clean and sanitary condition at all times. Remove at Project completion.
- O. Construction Water and Power: Make arrangements for all water and power required for the Project. Provide all temporary lines and arrange for billing to go directly to City. Remove temporary facilities at Project completion. See Bid Package for more detail. At City's option, contractor may be allowed to use onsite power and water where provided at existing areas.
- P. Project Signs: Furnish and erect a 3/4-inch by 48 inches by 96 inches. job sign painted and lettered to identify the Project, the Architect and the Contractor. Mount on post and brace as indicated by the Architect. Sign shall be lettered by a professional sign painter, and the layout shall be as indicated by the Architect. Keep the premises free from all other posters, signs, and miscellaneous decorations, except those required by Code and to indicate unsafe conditions.
- Q. Contractor shall examine the site and facilities prior to structure demolition, and temporary facilities and controls, to verify existing utilities and services are in proper



working order. Report any discrepancies to Architect and Cityy for review and approval. Any issues that arise at time of construction shall be the responsibility of the contractor.

R. Related Requirements:

1. Section 01 56 39 "Temporary Tree and Plant Protection," for tree and plant protection and pruning.

1.2 MEASUREMENT AND PAYMENT

- A. Full compensation for conforming to the provisions of this article shall be included in the contract items for which the work relates with no additional compensation allowed therefor.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used.

END OF SECTION 01 50 00

## SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Scope:

1. Contractor shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and perform tree and plant protection and trimming.
2. Extent of plantings to remain is shown on the Drawings. Extent of tree protection and trimming may include, but is not limited to, crown cleaning and crown thinning; in addition to drip line, root zone and tree trunk protection, and temporary barriers.
3. Types of products required may include, but are not specifically required to include the following:
  - a. Temporary protection barriers.
4. Plant Maintenance
  - a. Plants scheduled to remain, shall be irrigated and maintained as necessary to remain in a healthy and growing condition.

##### B. Coordination:

1. Review installation procedures under other Sections and coordinate construction activities and the installation of items that pass within the drip line, or that affect existing grade, in areas where existing plantings are to remain.
2. Coordinate with California Conservation Corp (CCC) for planting of trees. See Part H of these specifications for additional requirements.

##### C. Related Requirements:

1. Section 31 10 00, Site Clearing.
2. Section 32 84 00, Irrigation System.
3. Section 32 31 13, Chain Link Fence and Gates.
4. Section 32 93 00, Plants.
5. Section 32 96 00, Transplanting.
6. Sections 800 and 810, Standard Specifications for Public Improvements, 2015 Edition.

#### 1.2 REFERENCES

- ##### A. Standards referenced in this Section are listed below:

1. American National Standards Institute, (ANSI).
  - a. ANSI 300, Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance - Standard Practices.
  - b. ANSI 133 – Safety Requirements
- B. International Society of Arboriculture, (ISA).
  - a. Best Management Practices (BMP) – Managing Trees During Construction
  - b. Tree Pruning Guidelines.

### 1.3 ACTION SUBMITTALS

- A. Product Data: Submit product data for each material specified.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualifications Data: Submit qualifications data for the following:
  1. Professional arborist.
- B. Care and Maintenance Data: Submit typewritten instructions recommending procedures to be established by City for seasonal care and maintenance of trees affected by construction activities, after Substantial Completion.
- C. Certification: Submit the following:
  1. Certification by professional arborist that trees shown to remain were protected during the course of construction in accordance with recognized standards of the industry, as specified.
  2. Certification that where damage did occur, trees were promptly and properly treated, or replaced.

### 1.5 QUALITY ASSURANCE

- A. Professional Arborist Qualifications:
  1. If existing tree roots or canopy are to be trimmed or pruned, engage an accredited professional arborist, skilled, trained and with successful and documented experience in the protection and restorative care of trees, certified by the International Society of Arboriculture or American Society of Consulting Arborists. The arborist agrees to employ only tradesmen with specific skill and successful experience in this type of Work.
  2. s. The arborist agrees to employ only tradesmen with specific skill and successful experience in this type of Work.

3. Submit names and qualifications to Landscape Architect along with the following information on a minimum of three successful projects.
  - a. Names and telephone numbers of City, architects or engineers responsible for referenced projects.
  - b. Approximate contract cost of the tree protection and trimming.
  - c. Amount and kinds of tree protection and trimming performed.
- B. Tree Pruning Standards: Comply with ANSI A300 and ISA standards, unless more stringent requirements are specified, or required by Site conditions.
- C. Pre-installation Conference:
  1. Prior to commencement of site construction work, Contractor shall schedule and meet at the Site with professional arborist, installers of other site construction work in and around areas of existing plantings to remain, the City, the Landscape Architect and other representatives directly concerned with performance of the Work. Review foreseeable methods and procedures related to protection of existing plantings to remain, including the following:
    - a. Review Project requirements and the Contract Documents.
    - b. Review required submittals, both completed and yet to be completed.
    - c. Review availability of materials and methods of delivery.
    - d. Review location and types of below-grade work required access during construction and methods of protecting existing plantings.
    - e. Review Project Schedule and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
    - f. Review environmental conditions, other Project conditions, and procedures for coping with unfavorable conditions.
    - g. Review procedures needed for protection of plantings during the remainder of the construction period.
    - h. Review required inspection, testing, and certifying procedures.
  2. Record the discussions of the conference and the decisions and agreements or disagreements reached, and furnish a copy of the record to each party attending.
  3. Record all revisions or changes agreed upon, reasons therefor, and parties agreeing or disagreeing with them.
  4. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.

## 1.6 FIELD CONDITIONS

- A. Protection and Precautions:
  1. Protect existing trees and shrubs to remain during the course of construction in accordance with recognized standards of the industry, as specified.
  2. Where damage occurs, professional arborist shall promptly and properly treat trees in accordance with recognized standards, as specified.
  3. Replace damaged trees and shrubs, as specified, at no additional cost to the City where, in the opinion of the professional arborist or Landscape Architect,



damaged trees are incapable of retaining full growth potential, or have been damaged to the extent that they can no longer perform their intended function in the landscape.

## 1.7 EXTENDED SERVICE

- A. Any decline in the condition of existing trees or shrubs shall require Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, engage professional arborist or horticulturist to inspect trees or shrubs, identify problems and recommend corrective procedures. Advise Landscape Architect of all such actions and submit inspection and recommendation reports.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

1. Protection-Zone Fencing: Protective fencing is not specified for the protection of existing native vegetation for this project, however if it is deemed necessary to maintain the health and viability of existing vegetation near the limits of work, then the following standard applies:
  - a. Plastic Mesh Fencing: Heavy-duty orange plastic mesh fence fabric, 48 inches wide.
  - b. Fence Posts: Metal "U" or "T" Posts, minimum 60 inches long.

## PART 3 - EXECUTION

### 3.1 PERFORMANCE

- A. General:
1. Install temporary fencing, barricades or guards, located as recommended by professional arborist, outside the drip line of trees to remain in place and at the perimeter of any set aside areas indicated on plan, if these areas are potentially impacted by construction activities, storage of materials or staging.
  2. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
  3. Do not store materials, debris, topsoil or excavated subsoil within the drip line of trees to remain. Do not permit vehicles within drip line. Restrict foot, vehicle and equipment traffic to prevent compaction of soil over root systems.
  4. If pruning is recommended by the Arborist or Landscape Architect, cut branches and roots, if required, with sharp pruning instruments; do not break or chop.

### 3.2 EXCAVATION

- A. Do not excavate within tree drip line of trees or plants, unless otherwise indicated.
- B. Where excavation for new construction is required within tree drip lines, hand excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots. Backfill with topsoil where roots are exposed and compact to 85 percent reactive density.
- C. Where utility trenches are required within tree drip lines, tunnel under or around the roots by drilling, auger boring, pipe jacking, or digging by hand.
  - 1. Root Pruning: Do not cut roots 1 inch in diameter or larger; cut only roots less than 1 inch in diameter that interfere with installation of new work.

### 3.3 REGRADING

- 1. Maintain existing grade within drip line of trees, unless otherwise shown or specified.

### 3.4 TREE PRUNING

- A. To the greatest extent practicable, tie back tree branches as necessary to allow construction.
- B. Remove branches from trees to remain only with the approval of Landscape Architect or arborist and only as required to clear permanent construction, using branch removal methods in compliance with specified standards.
- C. Extend pruning operation to restore natural shape of entire tree where pruning is approved by Landscape Architect or Arborist.
- D. Prune branches to balance loss to root system caused by damage or cutting of root system.

### 3.5 TREE REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
  - 3. Coordinate with CCC for replacement of trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

- B. Trees: Coordinate with CCC for replacement of trees indicated to remain that are more than 66 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
  - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches (100 mm) or smaller in caliper size.
  - 2. Large Trees: Provide two new tree(s) of 6-inch (150-mm) caliper size for each tree being replaced that measures more than 6 inches (150 mm) in caliper size.
    - a. Species: As selected by Architect.
  - 3. Plant and maintain new trees as specified in Section 32 93 00 "Plants."

### 3.6 CLEAN-UP

- A. Burning of removed trees, chips and branches is not permitted on the Site.
- B. Remove protection barriers and load distributing layers when no longer needed and restore areas beneath trees and plants.

END OF SECTION 01 56 39

## SECTION 01 57 23 - TEMPORARY STORM WATER POLLUTION CONTROL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Temporary stormwater pollution controls.

#### 1.2 STORMWATER POLLUTION PREVENTION PLAN

- A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with City, Architect, and earthwork subcontractor.
  - 2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Stormwater Pollution Prevention Plan (SWPP): Within 15 days of date established for commencement of the Work, submit completed SWPPP.
- B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."
- C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.
- D. Inspection reports.

#### 1.5 QUALITY ASSURANCE

- A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.
  - 1. SWPPP Coordinator shall complete and finalize the SWPPP form.
  - 2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.



- B. Installers: Trained as indicated in the SWPPP.

## PART 2 - PRODUCTS

### 2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

- A. Provide temporary stormwater pollution controls as required by the SWPPP.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.
- B. Locate stormwater pollution controls in accordance with the SWPPP.
- C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.
  - 1. Inspect, repair, and maintain SWPPP controls during construction.
    - a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.
- D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 01 57 23

## SECTION 01 60 00 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 01 10 00 "Summary" for Contractor requirements related to City-furnished products.
  - 2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
  - 3. Section 01 77 00 "Closeout Procedures" for submitting warranties.

#### 1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
  - 3. w products unless otherwise indicated.
  - 4. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

- C. product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
  - 1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- D. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- E. comparable product request or substitution request, if applicable.
- F. comparable product request or substitution request, if applicable.
- G. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
  - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
  - 2. Data indicating compliance with the requirements specified in "Comparable Products" Article.
- H. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 33 00 "Submittal Procedures."
- I. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

### 1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

- a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
- b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products will be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
  - a. Name of product and manufacturer.
  - b. Model and serial number.
  - c. Capacity.
  - d. Speed.
  - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.



2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by City's construction forces. Coordinate location with City.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of City or endorsed by manufacturer to City.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for City and issued in the name of City or endorsed by manufacturer to City.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. City reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
  6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
  2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies

with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

- a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
  - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
  - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
  - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the

product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

8. nd Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
9. her named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
- F. . Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
  1. Select products for which sustainable design documentation submittals are available from manufacturer.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:



1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
  2. her portions of the Work.
  3. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  4. Evidence that proposed product provides specified warranty.
  5. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and Citys, if requested.
  6. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within seven working days of receipt of a request for a comparable product. Architect will notify Contractor of approval or rejection of proposed comparable product within 15 working days of receipt of request, or seven working days of receipt of additional information or documentation, whichever is later.
1. Architect's Approval of Submittal: Marked with approval notation from Architect's action stamp. See Section 01 33 00 "Submittal Procedures."
  2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.
- E. idual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

## SECTION 01 73 29 - CUTTING AND PATCHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Execute cutting, fitting or patching of work, required to:
  - 1. Make parts fit properly.
  - 2. Uncover work to provide for installation of ill-timed work.
  - 3. Remove and replace work not conforming to requirements of Contract Documents.
  - 4. Remove and replace defective work.
  - 5. Remove samples of installed work as specified for testing.
- B. In addition to Contract requirements, upon written instructions of Architect:
  - 1. Uncover work to provide for Architect's observation of covered work.
  - 2. Remove samples of installed materials for testing, when required.
- C. Do not endanger any work by cutting or altering work or any part of it.
- D. The Contractors with structural responsibility within their scope of work shall solely execute structural cutting and patching required for this project.
- E. Minor cutting and patching will be performed by the Contractor where required for the execution of his work. Locations of all trade cutting (core boring, etc.) shall be reviewed and approved by the Project Manager and Architect.
- F. Each Contractor shall make the field measurements necessary for his work and be responsible for its accuracy. Also, should any structural difficulties prevent a Contractor from installing his material properly, the Project Manager shall be promptly notified so that the Architect may be consulted how best to resolve the difficulty. Cutting into the walls and floors, if necessary, shall be carefully and neatly performed and then be repaired in an approved manner. The Architect shall be consulted in all cases where cutting into a structural portion of the building is either desirable or necessary so that satisfactory reinforcement may be provided.
- G. Patching of all exposed architectural finishes shall be performed under the supervision of the Project Manager, but executed by the affected finish trade contractor. Cutting and patching of existing architectural finishes shall be minimized to the extent possible through careful routing and placement of new work. The Architect shall have the authority to reject substandard or unacceptable patching.
- A. Patching of openings that are cut in any fire rated walls or membranes shall be sealed tightly using approved materials only. Verify that fire rating envelopes are maintained

and inspections provided prior to concealing work. Cutting and patching, if required by Agencies to verify adequacy of protection after concealment, shall be performed at no charge to the City.

## 1.2 ACTION SUBMITTALS

- A. Prior to cutting which affects structural safety of Project, submit written notice to the City and Architect requesting consent to proceed with cutting.
- B. Should conditions of work or schedule indicate change of materials or methods, submit written recommendation to the City and Architect, including:
  - 1. Conditions indicating change.
  - 2. Recommendations for alternative materials or methods.
  - 3. Submittals as required for substitutions.
  - 4. Quotations of charges or credits.
- C. Submit two (2) days in advance written notice to the City and Architect designating time work will be uncovered.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Materials for replacement of work removed: comply with specifications for type of work to be done.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine existing conditions of work, including elements subject to movement or damage during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of new products.

### 3.2 PREPARATION

- A. Preparation Prior to Cutting:
  - 1. Provide shoring, bracing and support as required to maintain structural integrity of work.
  - 2. Provide protection for other portions of work.
  - 3. Provide protection from elements.

### 3.3 PERFORMANCE

- A. Execute fitting and adjustment of products to permit finished installation to comply with specified tolerances and finishes.
- B. Perform cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work.

### 3.4 CONCRETE AND MASONRY CORING

- A. Cutting and coring of existing concrete walls, slabs and footings:
  - 1. No openings or cores shall be cut in or through concrete walls, slabs or footings unless they are specifically detailed on the structural drawings. Cutting and coring shall be performed as shown in the structural detail that pertains to that opening.
  - 2. All reinforcing shall be located by an independent testing laboratory at the contractor's expense or by the contractor (in either case there will be no additional cost to the City), using a pacometer device, prior to cutting. At walls and elevated slabs, the location of bars shall be determined on both sides of the wall or slab.
  - 3. The location of all reinforcing shall be marked with a semi- permanent mark showing where the bars are located, so it can be checked by the inspector of record, the City, and the structural engineer prior to cutting and after the work is completed. The location of bars shall be marked far enough beyond the opening to locate the steel after the work is completed.
  - 4. No openings or cores shall be cut where they will occur at or below a beam or girder support, through beams or girders, through thickened pilaster or column sections where they occur within walls, through columns or pilasters, within two feet (2'-0") of the end of a wall or wall section, nor within two feet (2'-0") of a window or door jamb.
  - 5. No reinforcing bars shall be cut through unless cutting of the bars is specifically detailed on the structural drawings or reviewed and approved by the structural engineer of record.
  - 6. The cutting of concrete shall be done with a saw cut or core drill. Do not over-cut the openings at the corners. The cutting at corners shall not extend beyond the opening size as detailed and marked on the wall.
  - 7. If a proposed opening does not match the location, size, or detail contained within the structural drawings, the architect shall be notified and the structural engineer shall review the proposed changes prior to cutting.
  - 8. If any bar is cut through that is not specifically detailed on the structural drawings as being cut, or bars are cut through that were not previously marked on the wall for inspection and review, the inspector of record, the architect, and the structural engineer shall be contacted prior to continuing with the work. The inspector of record, the architect, and the structural engineer shall be given adequate and reasonable time to review any changes to the documented reinforcing locations prior to continuing the work at that particular location.



9. All conflicts between the construction documents and the actual field conditions shall be brought to the attention of the architect and the structural engineer prior to continuing the work.

END OF SECTION 01 73 29

## SECTION 01 77 00 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final Completion procedures.
  - 3. List of incomplete items.
  - 4. Submittal of Project warranties.
  - 5. Final cleaning.
- B. Related Requirements:
  - 1. Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.

#### 1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Occupancy.
- C. Certificate of Insurance: For continuing coverage.
- D. Field Report: For pest-control inspection.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting City unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Certificate of Occupancy: Complete the information and obtain required City and Agency Clearances on City of Lancaster "Development Services Building & Safety Application for Certificate of Occupancy form DPW0500 10-22 (see sample form at end of Section). Submit form completed with clearances from City and Agencies to Community Development Division office located at 44933 Fern Avenue, Lancaster, CA 93534. Submit copy with transmittal to Architect and Owner's Representative; Frank Lujan.
  - 3. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 4. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
  - 6. Submit testing, adjusting, and balancing records.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Advise City of pending insurance changeover requirements.
  - 2. Make final changeover of permanent locks and deliver keys to City. Advise City's personnel of changeover in security provisions.
  - 3. Complete startup and testing of systems and equipment.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct City's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise City of changeover in utility services.
7. Participate with City in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

## 1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate



for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## 1.8 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding to buildings, listed by room or space number.
  2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit City's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  1. Submit on digital media acceptable to Architect.
- D. Warranties in Paper Form:
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch (215-by-280-mm)** paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

#### 1.10 MEASUREMENT AND PAYMENT

- A. Full compensation for conforming to the provisions of this article shall be included in the contract items for which the work relates with no additional compensation allowed therefor.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

### PART 3 - EXECUTION

#### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

- a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
- b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
- c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
- d. Remove tools, construction equipment, machinery, and surplus material from Project site.
- e. Remove snow and ice to provide safe access to building.
- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
- i. Vacuum and mop concrete.
- j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
- k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- l. Remove labels that are not permanent.
- m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
- q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- r. Clean strainers.
- s. Leave Project clean and ready for occupancy.

### 3.2 SAMPLE FORM – APPLICATION FOR CERTIFICATE OF OCCUPANCY

- A. See sample form; City of Lancaster "Development Services Building & Safety Application for Certificate of Occupancy form DPW0500 10-22.

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

END OF SECTION 01 77 00



## SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Systems and equipment operation manuals.
  - 2. Systems and equipment maintenance manuals.
  - 3. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

#### 1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Architect. Enable reviewer comments on draft submittals.
  - 2. Submit three paper copies. Architect will return two copies.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
- D. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

#### 1.5 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by City's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
  1. Product name and model number. Use designations for products indicated on Contract Documents.

2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

## 1.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by City's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.



- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.
- I. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  1. Do not use original project record documents as part of maintenance manuals.

## 1.7 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Product Information: Include the following, as applicable:
  1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- C. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- D. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- E. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  1. Include procedures to follow and required notifications for warranty claims.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

## SECTION 02 41 16- STRUCTURE DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of wall and footing
2. Demolition of concrete pad and curb
3. Fence removal

B. Related Sections:

1. Section 01 10 00 "Summary" for use of the premises and phasing requirements.
2. Section 01 32 00 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Section 02 41 19 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
4. Section 31 10 00 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

#### 1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage. Include fasteners or brackets needed for reattachment elsewhere.

#### 1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor. Salvage Items: Signage.

#### 1.4 SALVAGE ITEMS

- A. Unless otherwise indicated, remove and deliver to City of Lancaster Maintenance Facility, located at 615 West Avenue H, Lancaster, CA 93534.

#### 1.4 PRE-INSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project location
  - 1. Inspect and discuss condition of construction to be demolished.
  - 2. Review structural load limitations of existing structures.
  - 3. Review and finalize the building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review and finalize protection requirements.
  - 5. Review procedures for noise control and dust control.
  - 6. Review procedures for protection of adjacent buildings.
  - 7. Review items to be salvaged and returned to City.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Building Demolition Activities: Indicate the following:
  - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
  - 2. Temporary interruption of utility services.
  - 3. Shutoff and capping of utility services.
- C. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Submit before the Work begins.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.



## 1.2 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
  - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
  - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
    - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials will be removed by City before start of the Work.
  - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and City. Hazardous materials will be removed by City under a separate contract.
- D. On-site storage or sale of removed items or materials is not permitted.

## 1.3 COORDINATION

- A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

### 2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 31 20 00 "Earth Moving."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by City. City does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Make a detailed survey of existing conditions prior to commencing demolition, and report discrepancies or conflicts between the Drawings and actual conditions in writing to the Architect for clarification and instructions.
- D. Inventory and record the condition of items to be removed and salvaged.

### 3.2 PREPARATION

- A. Salvaged Items: Comply with the following:
  - 1. Clean salvaged items of dirt and demolition debris.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to City.
  - 4. Transport items to designated area.
  - 5. Protect items from damage during transport and storage.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
  - 1. The Contractor shall notify utility companies at least 21 calendar days prior to start of work.
  - 2. City will arrange to shut off utilities when requested by Contractor.
  - 3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
  - 4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
  - 5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
  - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by City and authorities having jurisdiction.
  - 2. Provide temporary services during interruptions to existing utilities, as acceptable to City and authorities having jurisdiction.
    - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 50 00 "Temporary Facilities and Controls."
  - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
  - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
  - 3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
  - 5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
  - 6. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated areas of site improvements. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from City and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
  2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.

### 3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5ft outside footprint indicated for new construction. Abandon below-grade construction outside this area.
  1. Remove below-grade construction, foundation walls, and footings completely
- D. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within footprint indicated for new construction. Abandon utilities outside this area.
  1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 31 20 00 "Earth Moving."
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.



### 3.7 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

### 3.8 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

### 3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 01 74 19 "Construction Waste Management and Disposal."
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

### 3.10 CLEANING

- A. Clean adjacent structures and improvement of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
  - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16

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

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Slabs-on-grade.
  - 4. Concrete toppings.
- B. Related Sections:
  - 1. Section 03 33 00 "Architectural Concrete" for general building applications of especially finished formed concrete.
  - 2. Section 03 53 00 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
  - 3. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.
  - 4. Section 32 13 16 "Decorative Concrete Paving" for decorative concrete pavement and walks.

#### 1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material and grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and

laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Engineer.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates, if required.
- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Curing compounds.
  - 6. Floor and slab treatments.
  - 7. Bonding agents.
  - 8. Adhesives.
  - 9. Vapor retarders.
  - 10. Semirigid joint filler.
  - 11. Joint-filler strips.
  - 12. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- E. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  1. ACI 301, "Specifications for Structural Concrete,"
  2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.

- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Deformed-Steel Wire: ASTM A 496/A 496M.
- D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

## 2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
  - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.



## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type II
  - 2. Retain supplementary cementing materials from first two subparagraphs below if permitted. Ready-mix concrete manufacturer blends these materials with portland cement. Fly ash, slag, or pozzolanic materials may slow rate of concrete strengthening and affect color uniformity. Availability of Class F fly ash predominates over Class C fly ash.
    - a. Fly Ash: ASTM C 618,
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33 coarse aggregate, graded. Provide aggregates from a single source. Retain coarse-aggregate size from three options in first subparagraph below; insert gradation requirements if preferred. Aggregate size limits relate to spacing of steel reinforcement, depth of slab, or thickness of concrete member.
  - 1. Maximum Coarse-Aggregate Size 1 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable

## 2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
  - 1. Products: Subject to compliance with requirements, provide the following
    - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
    - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
    - c. Euclid Chemical Company (The), an RPM company; Grace Construction Products, W. R. Grace & Co.; DCI.
    - d. Sika Corporation; Sika CNI.
    - e. Approved equal.

## 2.6 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials
  - 1. Products: Subject to compliance with requirements, provide the following
    - a. Anti-Hydro International, Inc.; Emery.
    - b. Dayton Superior Corporation; Emery Tuff Non-Slip.
    - c. Lambert Corporation; EMAG-20.
    - d. L&M Construction Chemicals, Inc.; Grip It.
    - e. Metalcrete Industries; Metco Anti-Skid Aggregate.
    - f. Approved Equal

## 2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Products: Subject to compliance with requirements, provide one of the the following
    - a. BASF Construction Chemicals - Building Systems; Confilm.
    - b. Sika Corporation; SikaFilm.
    - c. Approved Equal
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

- D. Water: Potable.
- E. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber
- F. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- G. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- H. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

## 2.8 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

## 2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Percentages in subparagraphs below repeat ACI 301 limits for concrete exposed to deicing chemicals. Revise to suit Project.
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
  - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  - 5. Silica Fume: 10 percent.
  - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  - 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

## 2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. Yd or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual,
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure



units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. cuous locations.

I. Chamfer, exterior corners and edges of permanently exposed concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F , for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
- C. ities.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.



- E. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
  - 1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
  - 2. After broadcasting and tamping, apply float finish.
  - 3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive

### 3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. lightly rounded.
- D. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

### 3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.

- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

### 3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. ons to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  4. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: City will engage qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  - 1. Steel reinforcement placement.
  - 2. Steel reinforcement welding.
  - 3. Verification of use of required design mixture.
  - 4. Concrete placement, including conveying and depositing.
  - 5. Curing procedures and maintenance of curing temperature.
  - 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd. plus one set for each additional 50 cu. yd. or fraction thereof.
  - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg. F and below and when 80 deg F and above, and one test for each composite sample.
  - 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure three sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
  - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. : Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
14. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
15. ith ASTM C 42/C 42M or by other methods as directed by Architect.
16. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.



- 17. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

### 3.14 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

**END OF SECTION 03 30 00**

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 03 33 00 - ARCHITECTURAL CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Cast-in-place architectural concrete, including form facings, reinforcement accessories, concrete materials, concrete mixtures, concrete placement, and concrete finishes.
2. Requirements in Section 03 30 00 "Cast-in-Place Concrete" apply to this Section.

#### 1.2 DEFINITIONS

- A. Aggregate Exposure: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.
- B. Cast-in-Place Architectural Concrete: Concrete that is exposed to view, is designated as architectural concrete, and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- D. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.
- E. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Form-facing panels.
2. Form liners.
3. Form joint tape.
4. Form joint sealant.
5. Wood sealer.
6. Form-release agent.
7. Surface retarder.
8. Form ties.

9. Bar supports.
10. Portland cement.
11. Fly ash.
12. Slag cement.
13. Blended hydraulic cement.
14. Silica fume.
15. Performance-based hydraulic cement.
16. Aggregates.
17. Admixtures:
  - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
18. Color pigments.
19. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic microfiber content.
11. Amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Intended placement method.
13. Alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Curing process.

D. Placement Schedule: Submit before start of placement operations.

#### 1.4 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Installer Qualifications: An experienced cast-in-place architectural concrete installer, as evidenced by not less than five consecutive years' experience, specializing in installing cast-in-place architectural concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
  - 1. Provide written evidence of qualifications and experience.
  - 2. Include locations, descriptions, and photographs of completed projects, including name of architect, substantiating the quality of the installer's experience.
- C. Mockups: Before casting architectural concrete, build mockups, using the same procedures, equipment, materials, finishing procedures, and curing procedures that will be used for producing architectural concrete, to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, color, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
- D. e under Sample submittals and to demonstrate typical joints, surface finish, color, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Build mockups of typical wall of cast-in-place architectural concrete as shown on Drawings, including vertical and horizontal rustication joints, and any sculptured features.
  - 3. , and any sculptured features.
  - 4. Construct mockups to include at least two lifts having heights equal to those anticipated for construction.
  - 5. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
  - 6. In presence of Architect, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair to match adjacent undamaged surfaces.
  - 7. In presence of Architect, demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
  - 8. Obtain Architect's approval of mockups before casting architectural concrete.



9. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with **ACI 301** (**ACI 301M**) unless modified by requirements in the Contract Documents.

### 2.2 FORM-FACING MATERIALS

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete" for formwork and other form-facing material requirements, and as specified in this Section.
- B. Form-Facing Panels for As-Cast Finishes:
1. Steel- and glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  2. Exterior-grade plywood panels, nonabsorptive, that will provide continuous, true, and smooth architectural concrete surfaces, medium-density overlay, Class 1, or better, mill-applied release agent and edge sealed, complying with DOC PS 1.
- C. Form Liners: Units of face design, texture, arrangement, and configuration to match design reference sample. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments and finishes of concrete.
- D. Rustication Strips: Metal, dressed wood, or rigid plastic, with sides beveled and back kerfed; nonstaining; in longest practicable lengths.
- E. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, **3/4 by 3/4 inch** (**19 by 19 mm**), minimum; nonstaining; in longest practicable lengths.
- F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800; minimum **1/4 inch** (**6 mm**) thick.
- G. Form Joint Sealant: Elastomeric sealant complying with ASTM C920, Type M or Type S, Grade NS, that adheres to form joint substrates, does not stain, does not adversely affect concrete surfaces, and does not impair subsequent treatments and finishes of concrete surfaces.
- H. Wood Sealer: Penetrating, clear, polyurethane wood sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood

and does not stain, does not adversely affect concrete surfaces, and does not impair subsequent treatments and finishes of concrete surfaces.

- I. impair subsequent treatments and finishes of concrete surfaces.
- J. Form-Release Agent: Commercially formulated, colorless form-release agent that does not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments and finishes of architectural concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  - 2. Form-release agent for form liners to be acceptable to form-liner manufacturer.
- K. Surface Retarder: Water-soluble chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed architectural concrete surface to depth of aggregate exposure specified.
- L. Form Ties: Factory-fabricated, glass-fiber-reinforced plastic ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish glass-fiber-reinforced plastic ties, not less than **1/2 inch (13 mm)** and not more than **1 inch (25 mm)** in diameter, of color selected by Architect from manufacturer's full range.

## 2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place.
  - 1. Manufacture bar supports in accordance with CRSI's "Manual of Standard Practice."
  - 2. Where legs of wire bar supports contact forms, use gray, all-plastic bar supports.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Materials:
  - 1. Portland Cement: ASTM C150/C150M, Type II, white.
  - 2. Fly Ash: Not allowed.
  - 3. Slag Cement: ASTM C989/C989M, Grade 100 or Grade 120.
  - 4. Blended Hydraulic Cement: ASTM C595/C595M, cement. Not allowed.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 5S or Class 5M coarse aggregate or better, graded. Provide aggregates from single source from single manufacturer.
  - 1. Maximum Coarse-Aggregate Size: **1 inch (25 mm)**.
  - 2. Gradation: Uniformly graded.

- C. Normal-Weight Fine Aggregate: ASTM C33/C33M, manufactured or natural sand, free of materials with deleterious reactivity to alkali in cement, from same source for entire Project.
- D. Air-Entraining Admixture: As specified in Section 03 30 00 "Cast-in-Place Concrete."
- E. Chemical Admixtures: As specified in Section 03 30 00 "Cast-in-Place Concrete," and certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- F. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
  - 1. Color: As selected by Architect from manufacturer's full range.
- G. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

## 2.5 CURING MATERIALS

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete."
  - 1. For integrally colored concrete, curing materials to be approved by color pigment manufacturer.
  - 2. For concrete indicated to be sealed, curing materials to be compatible with sealer.

## 2.6 REPAIR MATERIALS

- A. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy Bonding Adhesive: ASTM C881/C881M two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements.
  - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.7 CONCRETE MIXTURES, GENERAL

- A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.

- B. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, in accordance with **ACI 301 (ACI 301M)**.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
- D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockups.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.
  - 1. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
  - 2. For mixer capacity of **1 cu. yd. (0.76 cu. m)** or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 3. For mixer capacity larger than **1 cu. yd. (0.76 cu. m)**, increase mixing time by 15 seconds for each additional **1 cu. yd. (0.76 cu. m)**.
  - 4. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF FORMWORK

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring, and as specified in this Section.
- B. Limit deflection of form-facing panels to not exceed **ACI 301 (ACI 301M)** requirements.
- C. Limit cast-in-place architectural concrete surface irregularities, as follows:
  - 1. Surface Finish-3.0: **ACI 117 (ACI 117M)** Class A, **1/8 inch (3.0 mm)**.
- D. Construct forms to result in cast-in-place architectural concrete that complies with **ACI 117 (ACI 117M)**.
- E. Seal form joints, chamfers, rustication joints, and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.

1. Provide closure backing materials if indented rustication is used over a ribbed form line, and seal joint between rustication strip and form with joint sealant.
- F. Chamfer exterior corners and edges of cast-in-place architectural concrete.
- G. Coat contact surfaces of wood rustications and chamfer strips with wood sealer before placing reinforcement, anchoring devices, and embedded items.
- H. Coat contact surfaces of forms with form-release agent, in accordance with manufacturer's written instructions, before placing reinforcement, anchoring devices, and embedded items.
- I. Place form liners accurately to provide finished surface texture indicated.
  1. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting.
  2. Secure form liners in place using fasteners that will not transfer impressions onto surface of concrete.
  3. Prevent form liners from sagging and stretching in hot weather.
  4. Seal joints of form liners and form-liner accessories to prevent mortar leaks.
  5. Coat form liner with form-release agent.

### 3.2 INSTALLATION OF REINFORCEMENT AND ACCESSORIES

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete" for fabricating and installing steel reinforcement and accessories.

### 3.3 JOINTS

- A. Construction Joints: Install construction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.

### 3.4 CONCRETE PLACEMENT

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete."

### 3.5 FINISHING FORMED SURFACES

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete."
- B. Architectural Concrete Finish: Match approved mockup.



### 3.6 CONCRETE CURING

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete" using identical curing procedures to that used for mockups.

### 3.7 REPAIR

- A. Comply with **ACI 301** (ACI 301M).
- B. Repair damaged finished surfaces of cast-in-place architectural concrete when repairing is approved by Architect.
- C. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
- D. Remove and replace cast-in-place architectural concrete that cannot be repaired to Architect's approval.

### 3.8 FIELD QUALITY CONTROL

- A. Comply with Section 03 30 00 "Cast-in-Place Concrete."

### 3.9 CLEANING

- A. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
- B. Wash and rinse surfaces in accordance with concrete finish applicator's written instructions.
  - 1. Protect other Work from staining or damage due to cleaning operations.
  - 2. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

### 3.10 PROTECTION

- A. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.
- B. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

3.11 FINAL ACCEPTANCE

- A. Final acceptance of completed architectural concrete Work will be determined by Architect by comparing approved mockups with installed Work, when viewed at a distance of 10 feet (3 m).

END OF SECTION 03 33 00

## SECTION 03 37 13 - SHOTCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Wet-mix shotcrete.

#### 1.2 DEFINITIONS

- A. Shotcrete: Mortar or concrete pneumatically projected onto a surface at high velocity.
- B. Dry-Mix Shotcrete: Shotcrete with most of the mixing water added at nozzle.
- C. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

#### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with shotcrete to attend, including the following:
  - a. Contractor's superintendent.
  - b. Independent testing agency responsible for shotcrete design mixtures.
  - c. Ready-mix concrete manufacturer.
  - d. Shotcrete Installer.
2. Review methods and procedures related to shotcrete, but not limited to, the following:
  - a. Qualification data, equipment, and facilities needed to make progress and avoid delays.
  - b. Shotcrete finishes and finishing.
  - c. Cold- and hot-weather shotcreting procedures.
  - d. Curing procedures
  - e. Construction joints.
  - f. Forms and form-removal limitations.
  - g. Reinforcement accessory installation.
  - h. Shotcrete repair procedures.
  - i. Protection of shotcrete.

3. Before submitting design mixtures, review each shotcrete design mixture and examine procedures for ensuring quality of shotcrete materials.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
- B. Design Mixtures: For each shotcrete mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  1. For predampened dry-mix mixtures, indicate amounts of mixing water to be added to the dry-mix materials before mixing and conveying through the delivery hose.
- C. Shop Drawings: For shotcrete installation.
  1. Include plans, elevations, sections, and support and anchor details.
  2. Detail fabrication, bending, and placing of reinforcement; number and location of splices; and special reinforcement required for openings through shotcrete structures.
  3. Detail formwork fabrication, assembly, and support.
  4. Indicate locations of proposed construction joints.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following:
  1. Cementitious materials.
  2. Admixtures.
  3. Form materials.
  4. Steel reinforcement and accessories.
  5. Fiber reinforcement.
  6. Curing compounds.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer employing ACI-certified nozzle operators for Project, each of whom capable of performing shotcrete work within Skateboard Park as indicated on Drawings.

- B. Standard: Comply with ACI 506.2, "Specification for Shotcrete," unless otherwise indicated.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockups for each finish required and for each design mixture, shooting orientation, and nozzle operator.
  - 2. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 3. Demonstrate curing and protecting of shotcrete, finishes, and joints, as applicable.
  - 4. In presence of Architect, damage part of the exposed-face surface for each color and finish, and demonstrate materials and techniques proposed for repair of holes and surface blemishes to match adjacent undamaged surfaces.
  - 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS

- A. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practical sizes to minimize number of joints.

### 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.
- D. Welded Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire, furnished in flat sheet.
- E. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice" and as follows:
  - 1. For uncoated reinforcement, use CRSI Class 1, plastic-protected or CRSI Class 2, stainless steel bar supports.



## 2.3 SHOTCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I/II. Use only one brand and type of cement for Project.
  - 1. Fly Ash: ASTM C618, Class C or Class F.
- B. Normal-Weight Aggregates: ASTM C33/C33M, from a single source, and as follows:
  - 1. Combined Aggregate Size: ACI 506R, Grading No. 1 sieve analysis.
  - 2. Deleterious Substances: As specified for fine aggregate according to ASTM C33/C33M.
- C. Water: Potable, complying with ASTM C94/C94M, and free from deleterious materials that may affect color stability, setting, or strength of shotcrete.
- D. Synthetic Fiber: 100 percent virgin homopolymer polypropylene multifilament (monofilament) fibers engineered and designed for use in shotcrete, complying with ASTM C1116/C1116M, Type III, graded to 0.5-0.75 inches (13-20 mm) long.
- E. Ground Wire: High-strength steel wire, 0.8 to 1.0 mm in diameter.
- F. Joint Filler Strips: As recommended by Skateboard Park Design-Build sub-contractor.
- G. Admixtures: ASTM C1141/C1141M, Class A (liquid) or Class B (nonliquid), but limited to the following admixture materials. Provide admixtures for shotcrete that contain no more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.
  - 1. Accelerating Admixture, Conventional: ASTM C494/C494M, Type C or Type E.
  - 2. Pozzolanic Admixture: Fly ash, slag cement, and silica fume as limited in "Portland Cement" Paragraph in this article.
  - 3. Coloring Admixture: ASTM C979/C979M, synthetic mineral-oxide pigment or colored, water-reducing admixture, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.
  - 4. Air-Entraining Admixture: As limited in "Shotcrete Mixtures" Article.

## 2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry, or cotton mats.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

- D. Curing Compound: ASTM C309, Type 1, Class B; clear, waterborne, membrane-forming curing compound.

## 2.5 SHOTCRETE MIXTURES

- A. Refer to shotcrete mix designs indicated on Drawing sht. SK2.0.
- B. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties.
- C. Design Mixtures: Prepare design mixtures for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixture or field test data, or both.
- D. Cementitious Materials Replacing Portland Cement: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- E. Cementitious Materials, Maximum Content: Limit use of fly ash to not exceed, in combination, 20 percent of combined weight of fly ash and portland cement.
- F. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301 (ACI 301M).
- G. Admixtures: Use admixtures according to manufacturer's written instructions.
- H. Coloring Admixture: Add coloring admixture to shotcrete mixture according to manufacturer's written instructions and to result in hardened shotcrete color consistent with approved mockup.
- I. Design-Mixture Adjustments: Subject to compliance with requirements, shotcrete design-mixture adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.
- J. Shotcrete Mixture: Proportion mixture to provide shotcrete with the following properties:
  - 1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
  - 2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight wet-mix shotcrete having an air content before pumping of 3 percent with a tolerance of plus or minus 1-1/2 percent.
  - 3. Synthetic Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions, at a rate of 1.5 lb/cu. yd. (0.90 kg/cu. m).
  - 4. Color: As indicated by manufacturer's designation.

## 2.6 SHOTCRETE EQUIPMENT

- A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.
- B. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.
  - 1. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.
  - 2. rebound.
  - 3. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.
- C. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

## 2.7 BATCHING AND MIXING

- A. Dry-Mix Process: Measure mixture proportions by weight batching according to ASTM C94/C94M or by volume batching complying with ASTM C685/C685M requirements.
  - 1. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
  - 2. Prepackaged shotcrete materials may be used at Contractor's option. Predampen prepackaged shotcrete materials and mix before use.
- B. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C94/C94M and ASTM C1116/C1116M and furnish batch ticket information.
  - 1. Comply with ASTM C685/C685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Concrete and Masonry Substrates: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify

areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces to saturated, surface-dry condition before shotcreting.

- B. Earth Substrates: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces to saturated, surface-dry condition before shotcreting.

### 3.2 FORMS

- A. Design, erect, support, brace, and maintain forms, according to ACI 301 (ACI 301M), to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.
  - 1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
  - 2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.
- B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.
- C. ing such items. Accurately place and securely support items built into forms.

### 3.3 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.
- C. Securely embed reinforcing anchors into existing substrates, located as required.
- D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports, bolsters, chairs, spacers, and other devices as required to maintain minimum concrete cover.
- E. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.

- F. Install welded wire reinforcement in largest practical sheets on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.4 JOINTS

- A. General: Construct joints at locations indicated or as approved by Architect.
- B. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints unless otherwise indicated.
- C. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch- (3-mm-) wide by one-third of slab depth or joint-filler strips 1/4-inch- (6-mm-) wide by one-third of shotcrete depth unless otherwise indicated.
  - 1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
  - 2. Space joints at 10 feet o.c. horizontally and vertically.
  - 3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
  - 4. Where shooting over an existing substrate joint, align new shotcrete joint with existing joint.

### 3.5 ALIGNMENT CONTROL

- A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

### 3.6 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.7 APPLICATION

- A. Apply shotcrete applied by wet-mix process and according to ACI 506.2.
- B. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.



- C. Moisten wood forms immediately before placing shotcrete where form coatings are not used.
- D. Apply wet-mix shotcrete materials within 90 minutes after batching.
- E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
  - 1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
  - 2. Remove and dispose of cuttings during the trimming or rodding process to prevent unconsolidated material from falling onto lower reinforcement.
- F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray, and prevent buildup against front face during shotcreting.
- G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.
- H. Do not permit shotcrete to sag, slough, or dislodge.
- I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
- J. Do not disturb shotcrete surfaces before beginning finishing operations.
- K. Remove ground wires or other alignment-control devices after shotcrete placement.
- L. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.
- M. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117 (ACI 117M), increased by a factor of two.
- N. Cold-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 306.1 and as follows. Protect shotcrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling.
  - 2. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and no more than 90 deg F (32 deg C).
  - 3. Do not use frozen materials or materials containing ice or snow.
  - 4. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.

5. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
- O. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305.1 when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:
  1. Cool ingredients before mixing to maintain, at time of placement, shotcrete temperature below 90 deg F (32 deg C) for wet mix.
  2. Reduce temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

### 3.8 SURFACE FINISHES

- A. General: Finish shotcrete according to descriptions in ACI 506R.
- B. Natural Finishes:
  1. Gun Finish: Natural undisturbed finish as sprayed.
  2. Rod Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set. Do not push or float with flat part of trowel.
  3. Broom Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set; followed by uniform brooming.
- C. Finish-Coat with Final Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply shotcrete finish coat, 1/4 to 1 inch (6 to 25 mm) thick, using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding No. 4 (4.75-mm) sieve, and apply steel-trowel finish.

### 3.9 CURING

- A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
- B. Begin curing immediately after placing and finishing but not before free water, if any, has disappeared from shotcrete surface.
- C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.

- c. Water-saturated absorptive covers or moisture-retaining covers. Lap and seal sides and ends of covers with 12-inch (300-mm) lap over adjacent covers.
- 2. Curing Compound: Apply uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - a. Apply curing compound to natural gun and flash-coat finishes at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).
- D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

### 3.10 FORM REMOVAL

- A. Forms not supporting weight of shotcrete may be removed after curing for 24 consecutive hours at not less than 50 deg F (10 deg C), provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.
  - 1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

### 3.11 REPAIRS

- A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.
  - 1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs.
  - 2. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders.
  - 3. Dampen surfaces and apply new shotcrete. Match adjacent color and finish.

- B. Repair core holes from in-place testing according to repair provisions in ACI 301 (ACI 301M), except do not use shotcrete. Match adjacent color and finish.

### 3.12 CLEANING

- A. Immediately remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION 03 37 13

## SECTION 035300 - CONCRETE TOPPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Emery-aggregate concrete floor topping.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

#### 1.3 QUALITY ASSURANCE

A. Mockups: Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Build mockups approximately 100 sq. ft. (9.3 sq. m) in the location indicated or, if not indicated, as directed by Architect.
2. If Architect determines that mockups do not meet requirements, demolish and remove them from the site and cast others until mockups are approved.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 CONCRETE FLOOR TOPPINGS

A. Emery-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than 8 percent silica; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anti-Hydro International, Inc.
  - b. Laticrete International, Inc.
  - c. Metalcrete Industries.



- d. Or equal.
- 2. Compressive Strength (28 Days): 10,000 psi (69 MPa); ASTM C109/C109M.

## 2.2 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 25 percent solids content, minimum.

## 2.3 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids epoxy resin with a Type A Shore durometer hardness of 80 according to ASTM D2240.
- B. Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.
- C. Portland Cement: ASTM C150/C150M, Type I or II.
- D. Sand: ASTM C404, fine aggregate passing No. 16 (1.18-mm) sieve.
- E. Water: Potable.
- F. Acrylic-Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- G. Epoxy Adhesive: ASTM C881/C881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.
- H. Power-Actuated Fasteners: Fastener systems with an evaluation report based on ICC-ES AC70.

## 2.4 MIXING

- A. Bonding Slurry:

1. Mix portland cement with water to a thick paint consistency.
- B. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Verify that base concrete slabs comply with scratch finish requirements specified in Section 033000 "Cast-in-Place Concrete."
- C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method according to ASTM D4263.
- D. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm).
  1. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
  2. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.
  3. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch (13 mm) and fill with semirigid joint filler.
- B. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface unless otherwise indicated.
- C. Install power-actuated fasteners according to written directions of floor topping manufacturer at perimeter of areas that are to receive floor topping, including both edges of locations where joints will be formed in floor topping.

### 3.3 FLOOR TOPPING APPLICATION

- A. Start floor topping application in presence of manufacturer's technical representative.
- B. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs specified in Section 033000 "Cast-in-Place Concrete," place concrete floor topping while concrete is still plastic.
- C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while slurry is still tacky.
- D. Existing Concrete: Apply epoxy-bonding adhesive, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.
- E. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
  - 1. Screed surface with a straightedge and strike off to correct elevations.
  - 2. Slope surfaces uniformly where indicated.
  - 3. Begin initial floating, using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
- F. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
  - 1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
  - 2. until surface is smooth and uniform in texture.
    - a. Finish surfaces to specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15, and measure within 24 hours according to ASTM E1155 (ASTM E1155M) for a randomly trafficked floor surface.
    - b. Finish and measure surface, so gap at any point between surface and an unleveled freestanding 10-foot- (3-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch (6 mm).
- G. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.

1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.
- H. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.
  1. Form joints in concrete floor topping over contraction joints in base slabs unless otherwise indicated.
  2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
  3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch (13 mm) deep.

### 3.4 PROTECTING AND CURING

- A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.
- B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.
- C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with continuous water-fog spray or absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
  3. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.5 JOINT FILLING

- A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

### 3.6 REPAIR

- A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of completed applications of concrete floor toppings to take place in successive stages, in areas of extent and using methods as follows:
  - 1. Sample Sets: At point of placement, a set of three molded-cube samples to be taken from the topping mix for the first 1000 sq. ft. (93 sq. m), plus one set of samples for each subsequent 5000 sq. ft. (464 sq. m) of topping, or fraction thereof, but not less than six samples for each day's placement. Samples to be tested according to ASTM C109/C109M for compliance with compressive-strength requirements.
  - 2. Concrete floor topping to be tested for delamination by dragging a steel chain over the surface.
  - 3. Concrete floor topping to be tested for compliance with surface flatness and levelness tolerances.
- C. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 03 53 00



## SECTION 04 01 10 - MASONRY CLEANING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes cleaning the following:

1. Unit masonry surfaces.

#### 1.2 SEQUENCING AND SCHEDULING

- A. Work Sequence: Perform masonry-cleaning work in the following sequence:

1. Remove plant growth.
2. Inspect for open mortar joints. Where repairs are required, delay further cleaning work until after repairs are completed, cured, and dried to prevent the intrusion of water and other cleaning materials into the wall.
3. Remove paint.
4. Clean masonry surfaces.
5. Where water repellents are to be used on or near masonry, delay application of these chemicals until after cleaning.

- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units according to masonry repair Sections. Patch holes in mortar joints according to masonry repointing Sections.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include material descriptions and application instructions.
2. Include test data substantiating that products comply with requirements.

### PART 2 - PRODUCTS

#### 2.1 PAINT REMOVERS

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Cathedral Stone Products, Inc.
- b. PROSOCO, Inc.
- c. Or equal.

## 2.2 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of 140 to 160 deg F (60 to 71 deg C).
- C. Detergent Solution, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 1/2 cup (125 mL) of laundry detergent, and 20 quarts (20 L) of hot water for every 5 gal. (20 L) of solution required.
- D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing 2 cups (0.5 L) of tetrasodium pyrophosphate (TSPP), 5 quarts (5 L) of 5 percent sodium hypochlorite (bleach), and 15 quarts (15 L) of hot water for every 5 gal. (20 L) of solution required.
- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Cathedral Stone Products, Inc.
- b. PROSOCO, Inc.
- c. Or equal.

## 2.3 ACCESSORY MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. PROSOCO, Inc.
- b. Or equal.

## 2.4 CHEMICAL CLEANING SOLUTIONS

- A. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.
- B. Acidic Cleaner Solution for Nonglazed Masonry and Unpolished Stone: Dilute acidic cleaner with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended in writing by chemical-cleaner manufacturer.
  - 1. Stones: Use only on unpolished granite, unpolished dolomite marble, and siliceous sandstone.
- C. Acidic Cleaner for Glazed Masonry and Polished Stone: Dilute acidic cleaner with water to concentration demonstrated by testing that does not etch or otherwise damage glazed or polished surface, but not greater than that recommended in writing by chemical-cleaner manufacturer.
  - 1. Stones: Use only on polished granite and polished dolomite marble.

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
  - 1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
  - 2. Do not apply chemical solutions during winds of enough force to spread them to unprotected surfaces.
  - 3. Neutralize alkaline and acid wastes before disposal.
  - 4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- B. Remove gutters and downspouts and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.
  - 1. Provide temporary rain drainage during work to direct water away from building.

### 3.2 CLEANING MASONRY, GENERAL

- A. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from 20 feet (6 m) away by Architect.
- B. Proceed with cleaning in an orderly manner; work from top to bottom of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.
- C. Use only those cleaning methods indicated for each masonry material and location.
  - 1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
  - 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
    - a. Equip units with pressure gages.
    - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
    - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
    - d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
    - e. For heated water-spray application, use equipment capable of maintaining temperature between 140 and 160 deg F (60 and 71 deg C) at flow rates indicated.
    - f. For steam application, use steam generator capable of delivering live steam at nozzle.
- D. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.
- E. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed according to the "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.
- F. Water Application Methods:
  - 1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.

2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least 6 inches (150 mm) from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- G. Steam Cleaning: Apply steam to masonry surfaces at the very low pressures indicated for each type of masonry. Hold nozzle at least 6 inches (150 mm) from masonry surface and apply steam in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
- H. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces according to chemical-cleaner manufacturer's written instructions; use brush or spray application. Do not spray apply at pressures exceeding 50 psi (345 kPa). Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- I. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
  1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- J. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.

### 3.3 PRELIMINARY CLEANING

- A. Removing Plant Growth: Completely remove visible plant, moss, and shrub growth from masonry surfaces. Carefully remove plants, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and plant debris from open joints to whatever depth they occur.
- B. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods. Extraneous substances include paint, caulking, asphalt, and tar.
  1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
  2. Remove paint and caulking with alkaline paint remover.
    - a. Comply with requirements in "Paint Removal" Article.
    - b. Repeat application up to two times if needed.
  3. Remove asphalt and tar with solvent-type paste paint remover.



- a. Comply with requirements in "Paint Removal" Article.
- b. Apply paint remover only to asphalt and tar by brush without prewetting.
- c. Allow paint remover to remain on surface for 10 to 30 minutes.
- d. Repeat application if needed.

### 3.4 PAINT REMOVAL <Insert drawing designation>

- A. Paint-Remover Application, General: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- B. Paint Removal with Alkaline Paste Paint Remover:
  1. Remove loose and peeling paint using low-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
  2. Apply paint remover to dry, painted surface with brushes.
  3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
  4. Rinse with hot water applied by low-pressure spray to remove chemicals and paint residue.
  5. Repeat process if necessary to remove all paint.
  6. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
  7. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
- C. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
  1. Remove loose and peeling paint using low-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
  2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
  3. Apply cover according to manufacturer's written instructions.
  4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
  5. Scrape off paint and remover.
  6. Rinse with hot water applied by low-pressure spray to remove chemicals and paint residue.
  7. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
  8. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.

9. For spots of remaining paint, apply alkaline paste paint remover, according to "Paint Removal with Alkaline Paste Paint Remover" Paragraph.

### 3.5 CLEANING MASONRY <Insert drawing designation>

#### A. Detergent Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with cold water applied by low-pressure spray to remove detergent solution and soil.
4. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

#### B. Mold, Mildew, and Algae Removal:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply mold, mildew, and algae remover by brush or low-pressure spray.
3. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
4. Rinse with cold water applied by low-pressure spray to remove mold, mildew, and algae remover and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

#### C. Nonacidic Gel Chemical Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply gel cleaner in 1/8-inch (3-mm) thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Remove bulk of gel cleaner.
5. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

#### D. Nonacidic Liquid Chemical Cleaning:

1. Wet surface with hot water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

E. Mild-Acid Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

F. Acidic Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface in two applications by brush or low-pressure spray.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer.
4. Rinse with cold water applied by low-pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

### 3.6 FINAL CLEANING

- A. Clean adjacent nonmasonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.
- B. Remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- C. Remove masking materials, leaving no residues that could trap dirt.

END OF SECTION 04 01 10

## SECTION 04 22 00 - CONCRETE UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.
8. Masonry-cell insulation.

B. Related Sections:

1. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

#### 1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

#### 1.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

#### 1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: City will engage a qualified independent testing agency to perform preconstruction testing indicated below. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
  - 1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
  - 2. Mortar Test (Property Specification): For each mix required, according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
  - 3. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
  - 4. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
  - 5. Prism Test: For each type of construction required, according to ASTM C 1314.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
  - 1. Decorative CMUs, in the form of small-scale units.
  - 2. Colored mortar.
  - 3. Weep holes/vents.
- D. Samples for Verification: For each type and color of the following:
  - 1. Exposed CMUs.
  - 2. Accessories embedded in masonry.



## 1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  - 1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include data on material properties, material test reports substantiating compliance with requirements.
    - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  - 2. Cementitious materials. Include brand, type, and name of manufacturer.
  - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  - 4. Grout mixes. Include description of type and proportions of ingredients.
  - 5. Reinforcing bars.
  - 6. Joint reinforcement.
  - 7. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
  - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

- F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- E. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.
  - 1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
  - 2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
  - 3. Protect approved sample panels from the elements with weather-resistant membrane.
  - 4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of typical wall area as shown on Drawings.

2. Build mockups for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
  - a. Include a sealant-filled joint at least 16 inches long in each exterior wall mockup.
  - b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches) down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
  - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
  - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.9 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing

according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

## 2.2 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged units for outside corners unless otherwise indicated.
- C. Integral Water Repellent: Provide units made with integral water repellent for exposed units
  - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) ACM Chemistries, Inc.; RainBloc.
      - 2) BASF Corporation; MasterPel 240 (formally Rheopel Plus).
      - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
- D. CMUs: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1,500 psi
  - 2. Density Classification: Medium weight
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
  - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.



5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

E. Veneer Units:

1. Angeles Block 4-Score Split 1-side; 3-inches by 8-inches by 16-inches (special order).

## 2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Hydrated Lime: ASTM C 207, Type S.

- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

- D. Masonry Cement: ASTM C 91.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Capital Materials Corporation; Flamingo Color Masonry Cement.
- b. Cemex S.A.B. de C.V.;
- c. Essroc, Italcementi Group,;
- d. Holcim (US) Inc
- e. Lafarge North America Inc.;
- f. Lehigh Cement Company; National Cement Company, Inc.; Coosa Masonry Cement.

- E. Mortar Cement: ASTM C 1329.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement]

- F. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs, containing integral water repellent by same manufacturer.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ACM Chemistries, Inc.; RainBloc for Mortar.
    - b. BASF Corporation; MasterPel 240MA (formally Rheopel) Mortar Admixture.
    - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- I. Water: Potable.

## 2.4 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
  - 1. Interior Walls: Mill or hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon Stainless steel.
  - 3. Wire Size for Side Rods: 0.187-inch diameter.
  - 4. Wire Size for Cross Rods: 0.187-inch diameter.
  - 5. Wire Size for Veneer Ties: 0.187-inch diameter.
  - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
  - 7. Provide in lengths of not less than 10 feet
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

## 2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
  - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
  - 2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
  - 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
  - 4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 5. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

## 2.6 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- C. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

## 2.7 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
  - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Cheney Flashing Company.
      - 2) Keystone Flashing Company, Inc.

3) Sandell Manufacturing Co., Inc.

2. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

## 2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
    - b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    - c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

## 2.9 MASONRY-CELL INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply

with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Concrete Block Insulating Systems; Korfil.
  - b. Shelter Enterprises Inc.; Omni Core.

## 2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  1. Do not use calcium chloride in mortar or grout.
  2. Use portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.
  3. For exterior masonry, use portland cement-lime, masonry cement, mortar cement mortar.
  4. For reinforced masonry, use portland cement-lime, masonry cement, mortar cement mortar.
  5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated to provide required compressive strength of masonry.
  1. For masonry below grade or in contact with earth, use Type S
  2. For reinforced masonry, use Type S.
  3. For mortar parge coats, use Type S.
  4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type S.
  5. For interior non-load-bearing partitions, Type O may be used instead of Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.



1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

#### 3.3 TOLERANCES

- A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings] do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at

corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
  - 1. Install compressible filler in joint between top of partition and underside of structure above.
  - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors as noted on the drawings.
  - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
  - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
  1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
  2. Allow cleaned surfaces to dry before setting.
  3. Wet joint surfaces thoroughly before applying mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

### 3.6 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to one story high, but not more than 20 feet
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

### 3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
  1. Space reinforcement not more than 16 inches o.c.
  2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
  - 1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

### 3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control-joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

### 3.10 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.



### 3.11 FLASHING

- A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  - 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  - 4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
  - 5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
  - 6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
  - 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

### 3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  2. Limit maximum height of grout pours in one day to 12 feet.

### 3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: City will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
- B. Inspections: special inspections according to the "CBC." Is required for all masonry work
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

- G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

### 3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

### 3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

### 3.16 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  1. Crush masonry waste to less than 4 inches in each dimension.
  2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
  3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off City's property.

END OF SECTION 04 22 00

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Prefabricated building columns.
3. Grout.

B. Related Sections:

1. Section 01 40 00 "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
3. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
4. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings" for surface-preparation and priming requirements.

#### 1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
  2. Welded built-up members with plates thicker than 2 inches.
  3. Column base plates thicker than 2 inches).
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Connections: As detailed on the drawings. Contractor has no connection design responsibilities.
- B. Moment Connections: Type FR, fully restrained as detailed on the drawings.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
  - 1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
  - 2. Laboratory Test Reports for Credit IEQ 4: For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  - 5. Identify members and connections of the seismic-load-resisting system.
  - 6. Indicate locations and dimensions of protected zones.
  - 7. Identify demand critical welds.
- D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).

2. Electrode manufacturer and trade name, for demand critical welds.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Contractor, Installer and Fabricator.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
  1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  2. Direct-tension indicators.
  3. Tension-control, high-strength bolt-nut-washer assemblies.
  4. Shear stud connectors.
  5. Shop primers.
  6. Nonshrink grout.
- F. Source quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE or CSE.
- C. Shop-Painting Applicators: Qualified according to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- E. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303.

2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Pre-installation Conference: Conduct conference at Project site.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided City's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## 1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than the following:
  - 1. W-Shapes: 60 percent.
  - 2. Channels, Angles, M-Shapes: 60 percent.
  - 3. Plate and Bar: 25 percent.
  - 4. Cold-Formed Hollow Structural Sections: 25 percent.
  - 5. Steel Pipe: 25 percent.
  - 6. All Other Steel Materials: 25 percent.
- C. W-Shapes: ASTM A 992/A (Fy = 50 ksi; Fu = 65 ksi).
- D. Channels, Angles, M-Shapes: ASTM A 36/A 36M (Fy = 36 ksi; Fu = 58 ksi).
- E. Plate and Bar: ASTM A 36/A 36M (Fy = 36 ksi; Fu = 58 ksi).
- F. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50 (345).
- G. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B (Fy = 42 ksi; Fu = 58 ksi).
- H. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.
- I. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
  - 1. Weight Class: As shown on the drawings.
  - 2. Finish: Black except where indicated to be galvanized.
- J. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.
- K. Steel Forgings: ASTM A 668/A 668M.
- L. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.



- B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip or mechanically deposited zinc coating.
  - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, or mechanically deposited zinc coating, baked epoxy-coated finish.
- C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies (unless specifically noted on the drawings) consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
  - 1. Finish: Plain, unless shown otherwise on the drawings to be mechanically deposited zinc coating.
- D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
  - 1. Configuration: Straight.
  - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 5. Finish: Plain, unless galvanization is required per the Documents; provide mechanically deposited zinc coating, ASTM B 695, Class 50.
- F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 4. Finish: Plain, unless galvanization is required per the Documents; provide mechanically deposited zinc coating, ASTM B 695, Class 50.
- G. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 3. Finish: Plain, unless galvanization is required per the drawings; mechanically deposited zinc coating, ASTM B 695, Class 50.
- H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

- I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.
- K. Structural Slide Bearings: Low-friction assemblies, of type and configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.

## 2.3 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer: Comply with Sections 099113 "Exterior Painting," 099123 "Interior Painting," and 099600 "High-Performance Coatings," as applicable.
- C. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.
- D. Primer: SSPC-Paint 25 BCS, Type I, zinc oxide, alkyd, linseed oil primer.
- E. Primer: SSPC-Paint 23, latex primer.
- F. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- G. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20, ASTM A 780.

## 2.4 GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
  2. Fabricate beams with rolling camber up.
  3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  4. Mark and match-mark materials for field assembly.
  5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning, or SSPC-SP 2, "Hand Tool Cleaning, or SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.
- H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" as shown on the drawings for type of bolt and type of joint specified.
  - 1. Joint Type: As shown on the drawings as snug tightened, pretensioned or slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 PREFABRICATED BUILDING COLUMNS

- A. Prefabricated building columns consisting of load-bearing structural-steel members protected by concrete fireproofing encased in an outer non-load-bearing steel shell, by supplier shown on the drawings or approved equal.
- B. Fire-Resistance Ratings: Provide prefabricated building column listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.
  - 1. Fire-Resistance Rating: As indicated.

## 2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."
  - 3. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
  - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
9. SSPC-SP 8, "Pickling."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

## 2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
  2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

## 2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: City will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be tested and inspected by City-retained entity according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."



- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  - 1. Liquid Penetrant Inspection: ASTM E 165.
  - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Ultrasonic Inspection: ASTM E 164.
  - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

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

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, pretensioned or slip critical as shown on the drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs where indicated or allowed, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

### 3.5 PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: City will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
  1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.7 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

END OF SECTION 05 12 00

## SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. This Section includes requirements regarding the appearance and surface preparation of Architecturally Exposed Structural Steel. (AESS). Refer to division 5 section 'Structural Steel' for all other requirements regarding steel work not included in this section.

This section applies to any members noted on Architectural and Structural drawings as AESS 1, AESS 2, AESS 3, AESS 4 and AESS C; and in the areas defined as AESS below.

1. The following structural steel elements and connections are to be supplied and erected per AESS 4: All structural steel elements that are part of the entrance canopy structure.

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

1. Division 1
  - a. Section 01 33 00 "Submittal Procedures" for Fabrication Documents, Product Data, and Samples
  - b. Section 01 40 00 "Quality Requirements" for fabricator and installer qualifications independent testing agency procedures and administrative requirements.
  - c. Section 01 40 00 "Quality Requirements" for Source and Field quality control requirements.
2. Division 5 Sections 05 12 00 "Structural Steel Framing"
3. Division 9 Sections 09 96 00 "High Performance Coatings" for finish coat requirements and coordination with primer and surface preparation specified in this section.

#### 1.2 DEFINITIONS

- A. Architecturally Exposed Structural Steel: Structural Steel conforming to one of the categories of Architecturally Exposed Structural Steel or AESS Refer to ANSI/AISC 303-16 "Code of Standard Practice for Steel Buildings and Bridges".
- B. AESS 4: Structural Steel designated as "AESS 4 in the contract documents and conforming to ANSI/AISC 303-16, Chapter 10 definition of AESS4. These are showcase elements with special surface and edge treatment beyond fabrication. The intent is the form is the only feature showing in an element.



### 1.3 ACTION SUBMITTALS

- A. General: Submit each item below according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified. Submit "Special Coatings" under Division 9.
- C. Fabrication Documents: Detailing for fabrication of AESS components.
  - 1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
  - 2. Include details that clearly identify all the requirements listed in sections 2.3 "Fabrication" and 3.3 "Erection" of this specification for each part. Provide connections for exposed AESS consistent with concepts shown on the architectural or structural drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein.
  - 4. Indicate orientation of HSS seams and mill marks (where applicable).
  - 5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate which direction bolt heads should be oriented.
  - 6. Clearly indicate which surfaces or edges are exposed and what class of surface preparation is being used.
  - 7. Indicate special tolerances and erection requirements as noted on the drawings or defined herein.
  - 8. Indicate vent or drainage holes for HSS members.
- D. Mock Up: Provide mock ups of the nature and extent indicated on the contract documents.
  - 1. Locate mockups on-site or in the fabricator's shop as directed by Architect. Mockups shall be full size unless the Architect approves smaller models. Alternatively, when a mockup is not practical, the first piece of an element or connection can be used to determine acceptability.
  - 2. Notify the Architect one week in advance of the dates and times when mockups will be available for review.
  - 3. Demonstrate all applicable AESS characteristics for the specified category of AESS on the elements and joints in the mock up.
  - 4. Build mockups using member sizes and materials indicated for final Work.
  - 5. The mock up shall demonstrate weld quality and contouring of the welds at the aligned walls of the members.
  - 6. The mock up shall demonstrate the specified surface preparation and finish coating.
  - 7. HSS members shall extend at least 6" from the joint in the mock-up.

8. Obtain Architect's written approval of mockups before starting fabrication.
9. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
  - a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed work.
- E. Samples: Provide samples of specific AESS characteristics. Samples may be small size samples or components of conventional structural steel demonstrating the following specific AESS characteristics.
  1. Continuous weld appearance
  2. Sharp edges ground smooth
  3. Surface preparation
  4. Fabrication mark removal
  5. Weld show through.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. General: Submit each item below according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Qualification data for firms and persons specified in the 'Quality Assurance' Submittal to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and Citys, and other information specified.  
For each project, submit photographs showing detail of installed AESS.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: In addition to those qualifications listed in Division 5 Section 'Structural Steel', engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.
- B. Erector Qualifications: In addition to those qualifications listed in Division 5 Section 'Structural Steel', engage an AISC Certified Erector, experienced in erecting AESS work similar in material, design, and extent to that indicted for this Project and with a record of successful in-service performance.
- C. Comply with applicable provisions of the following specifications and documents:
  1. ANSI/AISC 303-16," Code of Standard Practice for Steel Buildings and Bridges", Section 10.
- D. Pre-installation Conference: The General Contractor shall schedule and conduct conference at the project site to comply with requirements of Division 1 Section "Project Meetings." As a minimum, the meeting shall include the General Contractor,

Fabricator, Erector, the finish-painting subcontractor, and the Architect. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch up painting, mock up coordination, architect's observations, and other requirements for AESS.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver AESS to Project site in such quantities and at such times to ensure continuity of installation. All tie downs on loads shall be nylon straps or shall use softeners when using chains or wire rope slings to avoid damage to edges and surfaces of members. The standard for acceptance of delivered and erected members shall be equivalent to the standard employed at fabrication.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.
- C. Handle finish pieces using nylon type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged. Conform to ANSI/AISC 303-16 Sections 10.4, 10.5, and 10.6.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Fabrication Documents. Coordinate fabrication schedule with construction progress to avoid delaying the work.

#### 1.8 COORDINATION

- A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation. Anchorage concepts shall be as indicated on drawings and approved on final Fabrication Documents.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Meet requirements Section 05 12 00 "Structural Steel."

#### 2.2 PAINT SYSTEM

- A. Compatibility: All components/procedures of the AESS paint system shall conform to the coating system specified, submitted, and approved per Division 9. As a minimum identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating and finish coating shall be from a single manufacturer combined in a system documented by the manufacturer with adequate guidance for the fabricator to procure and execute.
- B. Primer: Epoxy primer as specified in 09 96 00 "High Performance Coatings." Primer shall comply with all federal standards for VOC, lead and chromate levels.
- C. Finish Coating: Field apply intermediate and top coats per section 09 97 00.

## 2.3 FABRICATION AESS 1

- A. Use special care in handling and shipping of AESS both before and after shop painting minimize damage to any shop finish. Use Nylon type slings or softeners when using chains or wire rope slings.
- B. The permissible tolerances for member depth, width, out of square, and camber and sweep shall be as specified in ASTM A6/A6M-2014 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling (ASTM A6/A6M), ASTM A500/A500M-2013 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes (ASTM A500/A500M), and Standard Specification for Cold-Formed Welded Carbon Steel Structural Sections (HSS) (ASTM A1085/A1085M).
- C. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by the Architect. Detail AESS assemblies to minimize field handling and expedite erection.
- D. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
- E. Remove all backing and run out tabs.
- F. Grind all sharp edges smooth, including all sheared, punched or flame cut edges
- G. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.
- H. Bolted Connections: Make in accordance with Section 05 12 00. Provide bolt type and finish as noted herein.
- I. Weld Connections: Comply with AWS D1.1 and Section 05 12 00. Appearance and quality of welds shall be consistent. Assemble and weld built-up sections by methods

that will maintain alignment of members without warp exceeding the tolerance of this section.

- J. Install all bolts on the same side of the connection. Oriented uniformly in the direction indicated Consistent from one connection to another.
- K. Remove all weld spatter, slivers and similar surface discontinuities.
- L. Grind off projections larger than 1/16" at butt and plug welds.
- M. Continuous Weld Appearance: Where continuous welding is noted on the drawings, provide welds of a uniform size and profile
- N. Seal Welds: Seal weld open ends of round and rectangular hollow structural section with 3/8" closure plates. Provide venting as required for galvanized members.

## 2.4 FABRICATION AESS 2

- A. Fabricate to Requirements of 2.3 and as follows
- B. The as-fabricated straightness tolerance shall be one-half of that specified in ASTM A6/A6M, ASTM A500/A500M, or ASTM A1085/A1085M.
- C. For curved structural members, whether composed of a single standard structural shape or built-up, the as-fabricated variation from the theoretical curvature shall be equal to or less than the standard camber and sweep tolerances permitted for straight members in the applicable ASTM standard.
- D. The tolerance on overall profile dimensions of welded built-up members shall one-half of that specified in AWS D1.1/D1.1M: 2015 Structural Welding Code – Steel (AWS D1.1).
- E. Provide hidden part marks or piece marks that may be fully removed after erection.

## 2.5 FABRICATION AESS 3

- A. Fabricate to Requirements of 2.4 and as follows
- B. Fabricate AESS with exposed surfaces smooth, square and of surface quality consistent with the approved mock up.
- C. Grind projections at butt and plug welds to be smooth with the adjacent surface.
- D. Orientation of HSS seams shall be as shown.



- E. Copes, miters, and cuts in surfaces exposed to view shall have a maximum gap of 1/8" in an open joint. If the gap is shown to be in contact, the contact shall be uniform within 1/16".
- F. Mill marks shall not be exposed to view. If it is not possible to hide mill marks, then the mill marks are to be removed by appropriate length cutting of mill material. If this is not possible, the fabricator shall remove the mill mark, grind, and fill the surface to be consistent with the approved mock up.
- G. The matching of abutting cross sections is required

## 2.6 FABRICATION AESS 4

- A. Fabricate to the requirements of 2.5 and as follows.
- B. Contouring and blending of welds: Where welds are indicated to be ground contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.
- C. Minimize Weld Show Through: At locations where welding on the opposite side of an exposed connection creates distortion, weld show through shall be minimized to conform to the approved mock up.
- D. Open holes shall be filled with weld metal or body filler and smoothed by grinding or filling to the standards applicable to the shop fabrication of the materials.

## 2.7 SHOP PRIMING

- A. Provide surface preparations to SSPC-SP6. Coordinate the required surface profile with the approved paint submittal prior to beginning surface preparation. Prior to blasting remove any grease and oil using solvent cleaning to meet SSPC-SP 1. Weld spatter, slivers and similar surface discontinuities shall be removed. Sharp corners resulting from shearing, flame cutting or grinding shall be eased.
- B. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to be high-strength bolted with slip-critical connections,
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to AESS indicated for galvanizing according to ASTM A123/A123M – 2015 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products. Fabricate such that all connections of assemblies are made in the field with bolted connections.

## 2.10 FABRICATION QUALITY CONTROL AND QUALITY ASSURANCE AESS 1 AND 2

- A. Structural requirements:
  - 1. Conform to Quality Control requirements per ANSI/AISC 360-16 "Specification for Structural Steel Buildings" Chapter N and ANSI/AISC 303-16," Code of Standard Practice for Steel Buildings and Bridges", Section 10. Refer to Section 05 12 00 "Structural Steel" for additional requirements.
  - 2. City will engage a Quality Assurance agency per the requirements of ANSI/AISC 360-16 "Specification for Structural Steel Buildings" Chapter N and ANSI/AISC 303-16," Code of Standard Practice for Steel Buildings and Bridges", Section 10
- B. AESS acceptance: The Architect shall observe the AESS steel in the shop at a viewing distance consistent with the final installation and determine acceptability based on the qualification data and submittals. The Quality Assurance agency shall have no responsibility for enforcing the requirements of this section.

## 2.11 FABRICATION QUALITY CONTROL AND QUALITY ASSURANCE AESS 3 AND 4

- A. Conform to 2.10 and as follows.
- B. AESS acceptance: The Architect shall observe the AESS steel in the shop at a viewing distance consistent with the final installation and determine acceptability based on the approved mock up. The Quality Assurance Agency shall have no responsibility for enforcing the requirements of this section.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. The erector shall check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

### 3.2 PREPARATION

- A. Provide connections for temporary shoring, bracing and supports only where noted on the approved Fabrication Documents. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the

Architect. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain the appearance of the AESS through the process of erection.

### 3.3 ERECTION AESS 1

- A. Employ special care to handle and erect AESS. Erect finish pieces using nylon straps or chains with softeners such that they are not damaged.
- B. Place weld tabs for temporary bracing and safety cabling at points concealed from view in the completed structure or where approved by the Architect during the pre-installation meeting. Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection.
- C. AESS Erection tolerances: Erection tolerances shall meet the requirements of standard frame tolerances for structural steel per Chapter 7 of ANSI/AISC 303-16.
- D. Set AESS accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- E. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
- F. Remove all backing and run out tabs.
- G. When temporary braces or fixtures are required to facilitate erection, care shall be taken to avoid any blemishes, holes or unsightly surfaces resulting from the use or removal of such temporary elements.
- H. Bolted Connections: Align bolt heads on the same side of the connection as indicated on the approved fabrication or erection documents.
- I. Weld Connections: Comply with AWS D1.1 and Section 05 12 00. Appearance and quality of welds shall be consistent. Employ methods that will maintain alignment of members without warp exceeding the tolerance of this section.
- J. Remove all weld spatter exposed to view.
- K. Grind off projections larger than 1/16" at field butt and plug welds.
- L. Continuous Welds: Where continuous welding is noted on the drawings, provide continuous welds of a uniform size and profile.
- M. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
- N. Splice members only where indicated.

- O. Obtain permission for any torch cutting or field fabrication from the Architect. Finish sections thermally cut during erection to a surface appearance consistent with the mock up.

### 3.4 ERECTION AESS 2

- A. Erect to the requirements of 3.3 and as follows.
- B. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of ANSI/AISC 303-16.

### 3.5 ERECTION AESS 3

- A. Erect to the requirements of 3.4 and as follows.
- B. Field Welding: Weld profile, quality, and finish shall be consistent with mock-ups approved prior to fabrication.
- C. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.

### 3.6 ERECTION AESS 4

- A. Erect to the requirements of 3.5 and as follows.
- B. Welds ground smooth: Erector shall grind welds smooth.
- C. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection creates distortion, grind distortion and marking of the steel to a smooth profile with adjacent material.
- D. Filling of weld access holes: Where holes must be cut in the web at the intersection with flanges on W shapes and structural tees to permit field welding of the flanges, they shall be filled with joint filler.
- E. Where welds are indicated to be ground, contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.

### 3.7 FIELD QUALITY CONTROL AND QUALITY ASSURANCE AESS 1 and 2

- C. Structural requirements:
  - 3. Conform to Quality Control requirements per ANSI/AISC 360-16 "Specification for Structural Steel Buildings" Chapter N and ANSI/AISC 303-16," Code of Standard Practice for Steel Buildings and Bridges", Section 10. Refer to Section 05 12 00 "Structural Steel" for additional requirements.

4. City will engage a Quality Assurance agency per the requirements of ANSI/AISC 360-16 "Specification for Structural Steel Buildings" Chapter N and ANSI/AISC 303-16, "Code of Standard Practice for Steel Buildings and Bridges", Section 10

- D. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the qualification data and submittals. The Quality Assurance Agency shall have no responsibility for enforcing the requirements of this section.

3.8 FIELD QUALITY CONTROL AESS 3, 4, and C

- A. Conform to 3.7 and as follows.
- B. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the approved mock up. The Quality Assurance Agency shall have no responsibility for enforcing the requirements of this section.

3.9 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance with manufacturer's instructions and as specified in Division 9, Section "Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded area. Any repairs to galvanized surfaces shall comply with ASTM A780/A780M – 2015 Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

END OF SECTION 05 12 13



## SECTION 05 50 00 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Miscellaneous steel trim.
5. Metal bollards.
6. Floor plate.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 05 12 00 "Structural Steel Framing" for steel canopy framing, and other steel items attached to the structural-steel framing.

#### 1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. masonry. Deliver such items to Project site in time for installation.

### 1.3 ACTION SUBMITTALS

#### A. Product Data:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Manufactured metal ladders.
6. Metal bollards.

#### B. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Shelf angles.
3. Metal ladders.
4. Metal bollards.

### 1.4 INFORMATIONAL SUBMITTALS

#### A. Welding certificates.

### 1.5 QUALITY ASSURANCE

#### A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

### 1.6 FIELD CONDITIONS

#### A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

#### A. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.

## 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
- D. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- E. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- H. Zinc-Coated Steel Wire Rope: ASTM A741.
  - 1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- I. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
  - 1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
  - 2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) nominal thickness.
- K. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- L. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- M. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

- N. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- O. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless steel fasteners for fastening stainless steel.
  - 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593 (ISO 3506-1); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. ers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- I. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
  2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ISO 3506-1), and nuts, ASTM F594 (ASTM F836M).
- J. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting," Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings."
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.



- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.

- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with primer specified in Section 09 96 00 "High-Performance Coatings" where indicated.

## 2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
  - 1. Provide mitered and welded units at corners.
  - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.8 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3, and OSHA standards 1910.23, and 1910.28.
- B. Steel Ladders:
  - 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
  - 2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
  - 3. Rungs: 3/4-inch- (19-mm-) diameter , steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
  - 6. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
  - 7. Galvanize ladders, including brackets.

## 2.9 METAL FLOOR PLATE

- A. Fabricate from rolled-aluminum-alloy tread plate of thickness indicated below:
  - 1. Thickness: 1/4 inch (6.4 mm) .
- B. Provide aluminum angle supports as indicated.
- C. Include aluminum angle stiffeners, and fixed and removable sections as indicated.
- D. Provide flush bar drop handles for lifting removable sections, one at each end of each section.

## 2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Faceplates at Skateboard Park: ASTM A36 Steel plates, size and thickness indicated on drawings. Powder coat finish.

## 2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime steel bollards with primer specified in Section 099600 "High-Performance Coatings."

## 2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

- C. Galvanize loose steel lintels located in exterior walls.

## 2.13 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with primers recommended by fabricator for specified topcoats.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
  - 4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- F. Powder Coat Finish: Super Durable Polyester TGIC. Color as selected by Architect from powder coat manufacturer's standard color selections.

## 2.15 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
- C. Powder Coat Finish: Super Durable Polyester TGIC. Color as selected by Architect from powder coat manufacturer's standard color selections.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- D. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:



1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

### 3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to, and rigidly brace from, building structure.

### 3.3 INSTALLATION OF SHELF ANGLES

- A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

### 3.4 INSTALLATION OF METAL LADDERS

- A. Secure ladders to adjacent construction with the clip angles attached to the stringer.
- B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

### 3.5 INSTALLATION OF MISCELLANEOUS STEEL TRIM

- A. Anchor to concrete construction to comply with manufacturer's written instructions.

### 3.6 INSTALLATION OF METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

### 3.7 INSTALLATION OF HORIZONTAL RIBBED, CORRUGATED, PERFORATED METAL PANELS

- A. Miscellaneous Supports: Install subframing, and other miscellaneous panel support members and anchorages according to metal panel manufacturer's written recommendations.

- B. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Apply panels and associated items true to line.
  - 3. Install screw fasteners or bolts in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Apply panels and associated items true to line for neat and weathertight enclosure

### 3.8 REPAIRS

- A. Touchup Painting:
  - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
  - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 23 "Interior Painting, " except for manufacturer's factory finishes. For factory finish touchup, follow manufacturer's written instructions for field touchup of factory finish.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

## SECTION 05 53 13 - BAR GRATINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Metal bar gratings.
2. Grating frames and supports.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for structural-steel framing system components.
2. Section 05 52 13 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Clips and anchorage devices for gratings.
2. Paint products.

B. Shop Drawings:

1. Include plans, sections, and attachment details.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.
  2. Limit deflection to  $L/360$  or 1/4 inch (6.4 mm), whichever is less.
- B. Seismic Performance: Gratings to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
1. Component Importance Factor: As indicated on drawings.

## 2.2 METAL BAR GRATINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Golden State Grating, Inc.
  2. McNichols Company.
  3. Pacific Grating, Inc.
  4. Or equal.
- B. Metal Bar Grating Standards: Comply with NAAMM MBG 531.
- C. Welded Steel Grating:
1. Bearing Bar Spacing: 11/16 inch (17 mm) o.c.
  2. Bearing Bar Depth: 1 inch (25 mm) .
  3. Bearing Bar Thickness: 3/16 inch (4.8 mm).
  4. Crossbar Spacing: 4 inches (102 mm) o.c.
  5. Grating Mark W-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
  6. Traffic Surface: Plain .
  7. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.

## 2.3 GRATING FRAMES AND SUPPORTS

- A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
1. Unless otherwise indicated, fabricate from same basic metal as gratings.

2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

B. Galvanize steel frames and supports in the following locations:

1. Pump room.
2. Exterior locations.
3. Interior areas of high humidity, or wet areas.

## 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

## 2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.6 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Bars for Bar Gratings: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
- C. Wire Rod for Bar Grating Crossbars: ASTM A510/A510M.
- D. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30 (Grade 205).
- E. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.

## 2.7 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping



and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
  - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
  - 2. Fabricate toeplates for attaching in the field.
  - 3. Toeplate Height: 4 inches (100 mm) unless otherwise indicated.
- G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
  - 1. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
  - 2. Provide no fewer than four saddle clips for each grating section containing rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over two bearing bars.
  - 3. Provide no fewer than four weld lugs for each grating section containing rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced less than 15/16 inch (24 mm) o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
  - 4. Provide no fewer than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
  - 5. Furnish threaded bolts with nuts and washers for securing grating to supports.
  - 6. Furnish self-drilling fasteners with washers for securing grating to supports.

7. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
- H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
  1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- I. Do not notch bearing bars at supports to maintain elevation.

## 2.8 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
  1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
- G. Corrosion Protection: With a heavy coat of bituminous paint, coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals.

### 3.2 INSTALLATION OF METAL BAR GRATINGS

- A. Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

### 3.3 REPAIR

- A. Repair Painting:
1. Wire brush and clean rust spots, welds, and abraded areas on prime-painted gratings immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
  2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 53 13

## SECTION 05 70 00 - DECORATIVE METAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Decorative perforated metal panels.
2. Decorative mechanical grilles and frames.

B. Related Requirements:

1. Section 03 30 00 "Cast in Place Concrete," for footings at supports.
2. Section 05 50 00 "Metal Fabrications," for steel tube or pipe supports.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative metal.

1. Include plans, elevations, component details, and attachment details.
2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

#### 1.3 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 5 years experience in manufacturing decorative metals for commercial use.

B. Installer Qualifications: Fabricator of products.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the project site in manufacturer's original packaging, properly labeled for identification and installation purposes.
- B. Store in location to avoid damage from job-site traffic, direct sunlight, moisture, stacking or other job-site contaminants. Store in a completely supported flat position. Edge storage is not recommended.
- C. Handle components to avoid denting or scratching of finished surfaces.
- D. Do not use markers on protective PVC film. Some types of ink will permeate the film and mark the material surface.

#### 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Warranty Period: 10 years from date of Substantial Completion.
- C.



## PART 2 - PRODUCTS

### 2.1 DECORATIVE METAL FABRICATORS

- A. Fabricator: Subject to compliance with requirements, provide products by one of the following:
  - 1. Móz Designs, Inc.
  - 2. MetalTech USA.
  - 3. Zahner
  - 4. Or equal.

### 2.2 LAZER CUT ALUMINUM PANELS

- A. Laser Cut Aluminum; Moz Metals Deco pattern.
- B. 3/16 inch (5 mm) thick Aluminum: Type 5052 alloy complying with ASTM B209
- C. Sizes: As indicated on Drawings.
- D. Open Area: 53%.
- E. Border: 1-1/4 inch wide.
- F. Powder Coat finish, color as indicated on Drawings.

### 2.3 LAZER CUT ALUMINUM PANELS

- A. Laser Cut Aluminum; Moz Metals Flight pattern.
- B. 3/16 inch (5 mm) thick Aluminum: Type 5052 alloy complying with ASTM B209
- C. Sizes: As indicated on Drawings.
- D. Open Area: 17%.
- E. Border: 1-1/4 inch wide.
- F. Powder Coat finish, color as indicated on Drawings.
- G. Panel Pattern: Series (A,B,C).

## 2.4 METALS, GENERAL

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

## 2.5 ALUMINUM

- A. Fabricate products from alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Bars and Shapes: ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.
- C. Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
- D. Tubing: ASTM B210 (ASTM B210M), Alloy 6063-T832.
- E. Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 5005, or Alloy 5052.

## 2.6 FASTENERS

- A. Fasteners: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners, with factory applied powder coat finish in color to match panels.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

## 2.7 MISCELLANEOUS MATERIALS

- A. Panel Supports: Hat shaped channels or "Z" shaped brackets; aluminum, 1/8 inch (3 mm) minimum thickness. Provide with factory applied powder coat finish in color to match panels.

## 2.8 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly.
  - 1. Disassemble units only as necessary for shipping and handling limitations.
  - 2. Clearly mark units for reassembly and coordinated installation.
  - 3. Use connections that maintain structural value of joined pieces.

- B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged.
  - 1. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes.
  - 2. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
- C. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
- F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
- H. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

## 2.9 DECORATIVE MECHANICAL GRILLES

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Fabricate decorative grilles from perforated [aluminum] [brass] [bronze] [stainless steel] [steel] sheet or plate of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.
  - 1. Form perforations to match existing grilles.
  - 2. Drawings indicate perforated metal patterns required and are based on products of one manufacturer. Perforated metal patterns produced by other manufacturers

may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.

- C. Drill and countersink grilles for mounting screws at 2 inches (50 mm) from corners and at 10 inches (250 mm) or less o.c. Provide units with oval-head [wood] [self-tapping machine] screws.
- D. Fabricate grille frames from extruded [aluminum] [brass] [bronze] [stainless steel] [steel] of profiles and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates [welded] [brazed] to back of frames.
  - 1. Secure grilles in frames with 0.5-inch- (12-mm-) long [welds] [brazing] along perimeter of grilles at 4 inches (100 mm) o.c.
  - 2. Provide frame profiles to match existing frames.
  - 3. Drawings indicate frame profiles required and are based on products of one manufacturer. Similar frame profiles produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.
- E. Drill and countersink frames for mounting screws at 4 inches (100 mm) from corners and at 16 inches (400 mm) or less o.c. Provide units with oval-head [wood] [self-tapping machine] screws.

## 2.10 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## 2.11 ALUMINUM FINISHES

- A. Manufacturer's powder coat finish.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- D. proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- E. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- F. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- G. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
  - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- H. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- I. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.3 INSTALLATION OF DECORATIVE MECHANICAL GRILLES

- A. Mount decorative grilles at heights and in positions indicated, adjusting ductwork to be centered on grilles if any.
  - 1. Secure to framing and blocking with specified fasteners.



2. On marble, brick, and other solid surfaces, secure with wood screws in plastic plugs.

### 3.4 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Touchup Painting:
  1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
  2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."] [Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- E. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- F. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 70 00

## SECTION 06 10 00 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Shear wall panels.
5. Rooftop equipment bases and support curbs.
6. Wood blocking, cants, and nailers.
7. Wood furring and grounds.
8. Wood sleepers.
9. Utility shelving.
10. Plywood backing panels.

B. Related Requirements:

1. Section 06 10 63 "Exterior Rough Carpentry" for elevated decks and other exterior construction made of wood.
2. Section 06 16 00 "Sheathing."
3. Section 06 17 53 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

#### 1.2 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Timber: Lumber of 5 inches nominal or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
  2. NLGA: National Lumber Grades Authority.
  3. RIS: Redwood Inspection Service.
  4. SPIB: The Southern Pine Inspection Bureau.
  5. WCLIB: West Coast Lumber Inspection Bureau.

6. WWPA: Western Wood Products Association.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  3. ency.
  4. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
  5. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  6. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. LEED Submittals:
  1. Certificates for Credit MR 6: Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
  2. duct.
  3. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
  4. Product Data for Credit IEQ 4.4: For composite wood products, documentation indicating that product contains no urea formaldehyde.
  5. Laboratory Test Reports for Credit IEQ 4: For adhesives and composite-wood products], documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Fastener Patterns: Full-size templates for fasteners in exposed framing.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Engineered wood products.
  - 4. Shear panels.
  - 5. Power-driven fasteners.
  - 6. Powder-actuated fasteners.
  - 7. Expansion anchors.
  - 8. Metal framing anchors.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship" for the following:
  - 1. Dimension lumber framing.
  - 2. Timber.
  - 3. Laminated-veneer lumber.
  - 4. Parallel-strand lumber.
  - 5. Prefabricated wood I-joists.
  - 6. Rim boards.

7. Miscellaneous lumber.

- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
  - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 4. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
- D. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
  - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
  - 2. demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction use Category UC3b for exterior construction. No lumber may be in contact with the ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  - 2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.



- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  - 5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664 and design value adjustment factors shall be calculated according

to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
  - 1. Framing for raised platforms.
  - 2. Framing for stages.
  - 3. Concealed blocking.
  - 4. Framing for non-load-bearing partitions.
  - 5. Framing for non-load-bearing exterior walls.
  - 6. Roof construction.
  - 7. Plywood backing panels.

## 2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
  - 1. Application: Interior partitions not indicated as load-bearing.
  - 2. Species:
    - a. Hem-fir (north); NLGA.
    - b. Mixed southern pine; SPIB.
    - c. Spruce-pine-fir; NLGA.
    - d. Hem-fir; WCLIB, or WWPA.
    - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
    - f. Northern species; NLGA.
    - g. Eastern softwoods; NeLMA.
    - h. Western woods; WCLIB or WWPA.
- B. Load-Bearing Partitions: No. 2 or better grade.

1. Application: Exterior walls and interior load-bearing partitions.
  2. Species:
    - a. Hem-fir (north); NLGA.
    - b. Southern pine; SPIB.
    - c. Douglas fir-larch; WCLIB or WWPA.
    - d. Mixed southern pine; SPIB.
    - e. Spruce-pine-fir; NLGA.
    - f. Douglas fir-south; WWPA.
    - g. Hem-fir; WCLIB or WWPA.
    - h. Douglas fir-larch (north); NLGA.
    - i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Load-Bearing Partitions: Any species of machine stress-rated dimension lumber with a grade of not less than 2400f-2.0E.
1. Application: Exterior walls and interior load-bearing partitions.
- D. Load-Bearing Partitions: Any species and grade with a modulus of elasticity of at least 1,500,000 psi and an extreme fiber stress in bending of at least 1000 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.
1. Application: Exterior walls and interior load-bearing partitions.
- E. Ceiling Joists: Construction or No. 2 grade.
1. Species:
    - a. Hem-fir (north); NLGA.
    - b. Southern pine; SPIB.
    - c. Douglas fir-larch; WCLIB or WWPA.
    - d. Douglas fir-larch (north); NLGA.
    - e. Mixed southern pine; SPIB.
    - f. Spruce-pine-fir; NLGA.
    - g. Hem-fir; WCLIB or WWPA.
    - h. Douglas fir-south; WWPA.
    - i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
    - j. Northern species; NLGA.
    - k. Eastern softwoods; NeLMA.
    - l. Western woods; WCLIB or WWPA.
- F. Joists, Rafters, and Other Framing Not Listed Above: No. 1 or better grade.
1. Species:
    - a. Hem-fir (north); NLGA.
    - b. Southern pine; SPIB.
    - c. Douglas fir-larch; WCLIB or WWPA.

- d. Mixed southern pine; SPIB.
  - e. Spruce-pine-fir; NLGA.
  - f. Douglas fir-south; WWPA.
  - g. Hem-fir; WCLIB or WWPA.
  - h. Douglas fir-larch (north); NLGA.
  - i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- G. Joists, Rafters, and Other Framing Not Listed Above: Any species of machine stress-rated dimension lumber with a grade of not less than 2400f-2.0E.
- H. Joists, Rafters, and Other Framing Not Listed Above: Any species and grade with a modulus of elasticity of at least 1,500,000 psi and an extreme fiber stress in bending of at least 1000 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.
- I. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
- J. shake, splits, torn grain, and wane.
- 1. Application: Exposed exterior and interior framing indicated to receive a stained or natural finish.
  - 2. Species and Grade: As indicated above for load-bearing construction of same type.
  - 3. Species and Grade: Hem-fir (north); No. 1 grade; NLGA.
  - 4. Species and Grade: Southern pine; No. 1 grade; SPIB.
  - 5. Species and Grade: Douglas fir-larch; No. 1 grade; WCLIB or WWPA.
  - 6. Species and Grade: Mixed southern pine; Select Structural grade; SPIB.
  - 7. Species and Grade: Spruce-pine-fir; No. 1 grade; NLGA.
  - 8. Species and Grade: Douglas fir-south; No. 1 grade; WWPA.
  - 9. Species and Grade: Hem-fir; No. 1 grade; WCLIB or WWPA.
  - 10. Species and Grade: Douglas fir-larch (north); No. 1 grade; NLGA.
  - 11. Species and Grade: Spruce-pine-fir (south); No. 1 grade; NeLMA, WCLIB, or WWPA.
  - 12. Species and Grade: Eastern hemlock-balsam fir or eastern hemlock-tamarack; No. 1 grade; NeLMA.
  - 13. Species and Grade: Beech-birch-hickory; No. 1 grade; NeLMA.
  - 14. Species and Grade: Northern red oak; No. 1 grade; NeLMA.
  - 15. Species and Grade: Redwood; No. 1 grade; RIS.
  - 16. Species and Grade: Mixed oak; No. 1 grade; NeLMA.
  - 17. Species and Grade: Mixed maple; No. 1 grade; NeLMA.
  - 18. Species and Grade: Western cedars; No. 1 grade; WCLIB or WWPA.

## 2.5 TIMBER FRAMING

- A. Provide timber framing complying with the following requirements, according to grading rules of grading agency indicated:
1. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; No. 1 grade; NLGA, WCLIB, or WWP.
  2. Species and Grade: Eastern hemlock, eastern hemlock-tamarack, or eastern hemlock-tamarack (north); No. 1 grade; NeLMA or NLGA.
  3. Species and Grade: Hem-fir or hem-fir (north); No. 1 grade; NLGA, WCLIB, or WWP.
  4. Species and Grade: Mixed maple; No. 1 grade; NeLMA.
  5. Species and Grade: Mixed oak; No. 1 grade; NeLMA.
  6. Species and Grade: Southern pine; No. 1 grade; SPIB.
  7. Maximum Moisture Content: 19 percent.
  8. Additional Restriction: Free of heart centers.

## 2.6 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products, General: Products shall contain no urea formaldehyde and comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- C. Laminated-Veneer Lumber: Use products and manufacturers set forth on the drawings, or approved equal. Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Extreme Fiber Stress in Bending, Edgewise: 3100 psi for 12-inch nominal-depth members.
  2. Modulus of Elasticity, Edgewise: 2,000,000 psi.
- D. Parallel-Strand Lumber: Use products and manufacturers set forth on the drawings, or approved equal. Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Extreme Fiber Stress in Bending, Edgewise: 2900 psi (20 MPa) for 12-inch nominal- (286-mm actual-) depth members.
  2. Modulus of Elasticity, Edgewise: 2,200,000 psi (15 100 MPa).



- E. Wood I-Joists: Use products and manufacturers set forth on the drawings, or approved equal. Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Provide units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
  - 1. Web Material: Either oriented strand board or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
  - 2. Structural Properties: Provide units with depths and design values not less than those indicated.
  - 3. Provide units complying with APA PRI-400, factory marked with APA trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.
- F. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
  - 1. Manufacturer: Provide products by same manufacturer as I-joists.
  - 2. Material: All-veneer product, glued-laminated wood, or product made from any combination solid lumber, wood strands, and veneers.
  - 3. Thickness: 1-1/4 inches.
  - 4. Provide performance-rated product complying with APA PRR-401, rim board plus grade, factory marked with APA trademark indicating thickness, grade, and compliance with APA standard.

## 2.7 SHEAR WALL PANELS

- A. Manufacturers: Use products and manufacturers set forth on the drawings, or approved equal.
- B. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
  - 1. Products shall contain no urea formaldehyde and shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized steel panel, steel top and bottom plates, and wood studs.
- D. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated on the drawings, or products of manufacturers listed, whichever is greater. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.8 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Rooftop equipment bases and support curbs.
  4. Cants.
  5. Furring.
  6. Grounds.
  7. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
1. Hem-fir (north); NLGA.
  2. Mixed southern pine; SPIB.
  3. Spruce-pine-fir; NLGA.
  4. Hem-fir; WCLIB or WWPA.
  5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
  6. Western woods; WCLIB or WWPA.
  7. Northern species; NLGA.
  8. Eastern softwoods; NeLMA.
- C. For utility shelving, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  2. Mixed southern pine; No. 2 grade; SPIB.
  3. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
  4. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine; No. 2 grade; SPIB.
  2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
  3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  4. Eastern softwoods; No. 2 Common grade; NeLMA.
  5. Northern species; No. 2 Common grade; NLGA.
  6. Western woods; Construction or No. 2 Common Common grade; WCLIB or WWPA.

- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.9 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged or better, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
  - 1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.10 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M, unless noted on the drawings as stainless steel (use Type 304 stainless steel).
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when

installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

## 2.11 METAL FRAMING ANCHORS

- A. Manufacturers: Use products and manufacturers set forth on the drawings, or approved equal.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those that may be indicated on the drawings. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
  1. Use for wood-preservative-treated lumber and where indicated.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304 or Type 316 unless specified otherwise on the drawings.
  1. Use for exterior locations and where indicated.
- F. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.
  1. Thickness: 0.062 inch.
- G. I-Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges full depth of joist. Nailing flanges provide lateral support at joist top chord.
  1. Thickness: 0.062 inch.

- H. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
  - 1. Strap Width: 2 inches.
  - 2. Thickness: 0.062 inch.
- I. Bridging: Rigid, V-section, nail less type, 0.050 inch thick, length to suit joist size and spacing.
- J. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch-minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.
- K. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
  - 1. Width: 1-1/4 inches.
  - 2. Thickness: 0.062 inch.
  - 3. Length: 24 inches unless noted otherwise on the drawings.
- L. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. Tie fastens to side of rafter or truss, face of top plates, and side of stud below.
- M. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
- N. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, 1-1/4 inches wide by 0.050 inch thick by 36 inches long.
- O. Hold-Downs: Unless shown otherwise on the drawings, brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
  - 1. Bolt Diameter: 3/4 inch.
  - 2. Width: 3-3/16 inches.
  - 3. Body Thickness: 0.138 inch.
  - 4. Base Reinforcement Thickness: 0.239 inch.
- P. Wall Bracing: T-shaped bracing made for letting into studs in saw kerf, 1-1/8 inches wide by 9/16 inch deep by 0.034 inch thick with hemmed edges.
- Q. Wall Bracing: Angle bracing made for letting into studs in saw kerf, 15/16 by 15/16 by 0.040 inch thick with hemmed edges.



## 2.12 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- D. Adhesives for Gluing, Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
  - 1. Adhesives shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.
- F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal-thickness.
  - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
  - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- K. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.

- M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- O. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
  - 1. Comply with fastener patterns shown on the drawings. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
  - 2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
  - 3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

### 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board and Plaster Lath: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

### 3.4 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.
  - 1. For exterior walls, provide 2-by-6-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
  - 2. For interior partitions and walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
  - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
  - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated or, if not indicated, according to Table R502.5(1) or Table R502.5(2), as applicable, in ICC's International Residential Code for One- and Two-Family Dwellings.
- D. Provide diagonal bracing in exterior walls, at both walls of each external corner, at 45-degree angle, full-story height unless otherwise indicated. Use 1-by-4-inch nominal-size boards, let-in flush with faces of studs or metal wall bracing, let into studs in saw kerf.

### 3.5 FLOOR JOIST FRAMING INSTALLATION

- A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
  - 1. Where supported on wood members, by toe nailing or by using metal framing anchors.
  - 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.
- C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.
- D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.
- E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.
- H. Provide solid blocking between joists under jamb studs for openings.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
  - 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.
  - 1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal-size lumber, double-crossed and nailed at both ends to joists.
  - 2. Steel bridging installed to comply with bridging manufacturer's written instructions.

### 3.6 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
  - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
  - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
  - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

### 3.7 TIMBER FRAMING INSTALLATION

- A. Install timber with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
- B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch air space at sides and ends of wood members.
- C. Install wood posts using metal anchors indicated.
- D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.



### 3.8 STAIR FRAMING INSTALLATION

- A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
  - 1. Size: 2-by-12-inch nominal-size, minimum.
  - 2. Material: Laminated-veneer lumber, parallel-strand lumber, or solid lumber.
  - 3. Notching: Notch rough carriages to receive treads, risers, and supports; leave at least 3-1/2 inches of effective depth.
  - 4. Spacing: At least three framing members for each 36-inch clear width of stair.
- B. Provide stair framing with no more than 3/16-inch variation between adjacent treads and risers and no more than 3/8-inch variation between largest and smallest treads and risers within each flight.

### 3.9 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. I.

END OF SECTION 06 10 00

## SECTION 06 16 00 - SHEATHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Sheathing joint-and-penetration treatment materials.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.
2. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing.
2. Roof sheathing.
3. Sheathing joint-and-penetration treatment materials.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.
- C. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.
  1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
  2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
  3. Include details of interfaces with other materials that form part of air barrier.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, including list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For the following, from ICC-ES:
  1. Wood-preserved-treated plywood.
  2. Fire-retardant-treated plywood.
  3. Foam-plastic sheathing.
  4. Air-barrier and water-resistant glass-mat gypsum sheathing.
- E. Field quality-control reports.

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
  1. Installer is to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and is to employ ABAA-certified installers and supervisors on Project.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing Performance: Air-barrier and water-resistant glass-mat gypsum sheathing assembly, and seals with adjacent construction, are to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies are to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to other installed air barriers, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

### 2.2 WOOD PANEL PRODUCTS

- A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

### 2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

## 2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  1. Use treatment that does not promote corrosion of metal fasteners.
  2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
  3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings.

## 2.5 WALL SHEATHING

- A. Plywood Sheathing, Walls: DOC PS 1, Exposure 1, Structural I sheathing.
  1. Span Rating: As indicated on drawings.
  2. Nominal Thickness: As indicated on drawings.

- B. Oriented-Strand-Board Sheathing, Walls: DOC PS 2, Exposure 1, Structural I sheathing.
  - 1. Span Rating: As indicated on drawings.
  - 2. Nominal Thickness: As indicated on drawings.
- C. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.
  - 1. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
  - 2. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.
- D. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M, Type X, coated fiberglass mat gypsum sheathing with integral weather-resistant barrier and air barrier complying with ASTM E2178.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Georgia-Pacific Gypsum LLC.
    - b. USG Corporation.
    - c. Or equal.
  - 2. Thickness: 5/8 inch (15.9 mm) thick.
  - 3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.
  - 4. Edges: Square.
  - 5. Flashing and Transitions Strips: As acceptable to sheathing manufacturer.
  - 6. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference when tested in accordance with ASTM E2178.
  - 7. Vapor Permeance: Minimum 20 perms (580 ng/Pa x s x sq. m) when tested in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.
  - 8. Sheathing Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa) when tested in accordance with ASTM E2357.
  - 9. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.
  - 10. f an approved assembly.
  - 11. UV Resistance: Can be exposed to sunlight for 90 days in accordance with manufacturer's written instructions.
  - 12. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by sheathing manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
  - 13. ier material and adjacent construction to which they may seal.
  - 14.



## 2.6 ROOF SHEATHING

- A. Plywood Sheathing, Roofs: DOC PS 1, Exposure 1, Structural I sheathing.
  - 1. Span Rating: As indicated on drawings.
  - 2. Nominal Thickness: As indicated on drawings.
- B. Oriented-Strand-Board Sheathing, Roofs: DOC PS 2, Exposure 1, Structural I sheathing.
  - 1. Span Rating: As indicated on drawings.
  - 2. Nominal Thickness: As indicated on drawings.

## 2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
  - 1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C1002.
  - 2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C954.
- G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

## 2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Paper-Surfaced and Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- B. um sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- C. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
  - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- D. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

## 2.9 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. ICC-ES evaluation report for fastener.

- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Nail to wood framing.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch (3 mm) apart at edges and ends.

### 3.3 INSTALLATION OF GYPSUM SHEATHING

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to wood framing with nails or screws.
  - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
  - 4. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of

adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
  2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
  2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
  2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
- F. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing:
1. Install accessory materials in accordance with sheathing manufacturer's written instructions and details to form a seal with adjacent construction, to seal fasteners, and ensure continuity of air and water barrier.
    - a. Coordinate the installation of sheathing with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
    - b. Install transition strip on roofing membrane or base flashing, so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
  2. Connect and seal sheathing material continuously to air barriers specified under other Sections as well as to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

3. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
4. on temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
5. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion, so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
  - a. Transition Strip: Roll firmly to enhance adhesion.
  - b. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
6. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of sheathing material with foam sealant.
7. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
8. Seal top of through-wall flashings to sheathing with an additional 6-inch- (150-mm-) wide, transition strip.
9. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
10. Repair punctures, voids, and deficient lapped seams in strips and transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

### 3.4 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing and Inspecting Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  3. Termination mastic has been applied on cut edges.
  4. Strips and transition strips have been firmly adhered to substrate.
  5. Compatible materials have been used.

6. Transitions at changes in direction and structural support at gaps have been provided.
  7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  8. All penetrations have been sealed.
- D. Tests: As determined by testing agency from among the following tests:
1. Air-Leakage-Location Testing: Air-barrier sheathing assemblies will be tested for evidence of air leakage in accordance with ASTM E1186, chamber pressurization or depressurization with smoke tracers.
  2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with ASTM E783.
- E. Air barriers will be considered defective if they do not pass tests and inspections.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.

END OF SECTION 06 16 00



## SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior trim.
2. Shelving and clothes rods.
3. Interior Frames and Jambs for Opaque Finish.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 09 91 23 "Interior Painting" for priming and backpriming of interior finish carpentry.

#### 1.2 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. MDO: Plywood with a medium-density overlay on the face.
- C. PVC: Polyvinyl chloride.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Interior trim.
2. Shelving and clothes rods.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.

2. or finishing treated material.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
  1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Softwood Plywood: DOC PS 1.
- C. Hardboard: ANSI A135.4.
- D. MDF: ANSI A208.2, Grade 130.
- E. Particleboard: ANSI A208.1, Grade M-2.
- F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with ISO 4586-3, Grade VGS.
  1. Color: White .

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC1; exception: UC2 in wet or damp areas.
  1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
  2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.

4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
  - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
  - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: Where indicated on Drawings . Wood door frames, trim, base or casing in contact with concrete that is direct contact with soil.

## 2.3 INTERIOR TRIM

### A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: Red oak, White maple, Ash, or Hickory; NHLA FAS.
2. Maximum Moisture Content: 9 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Use for lumber trim wider than 6 inches (150 mm).
5. Veneered Material: Allowed .
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.

### B. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade:
  - a. Douglas fir-larch or Douglas fir south; WCLIB, or WWPA Prime or D finish.
  - b. Spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPA 2 Common.
2. Maximum Moisture Content for Softwoods: 19 percent.
3. Maximum Moisture Content for Hardwoods: 9 percent.
4. Finger Jointing: Allowed.
5. Face Surface: Surfaced (smooth).
6. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

### C. Softwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings. Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
  2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
  3. Finger Jointing: Not allowed.
  4. Matching: Selected for compatible grain and color.
  5. Patterns: As indicated on drawings.
- D. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings made to patterns included in MMPA's "HWM/Series Hardwood Moulding Patterns."
1. Species: Red oak, White maple, Ash, or Hickory .
  2. Maximum Moisture Content: 9 percent.
  3. Finger Jointing: Not allowed.
  4. Matching: Selected for compatible grain and color.
  5. Optional Material: Kiln-dried softwood or MDF, with exposed surfaces veneered with species indicated, may be used in lieu of solid wood.
  6. Patterns: As indicated on drawings.
- E. Moldings for Opaque Finish (Painted Finish): Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
1. Softwood Moldings: MMPA WM 4, P grade.
    - a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
    - b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
  2. Hardwood Moldings: MMPA WM 4, P-grade.
    - a. Species: Aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar.
    - b. Maximum Moisture Content: 9 percent.
  3. Finger Jointing: Allowed.
  4. Optional Material: Primed MDF.
  5. Patterns: As indicated on drawings.

## 2.4 SHELVING AND CLOTHES RODS

- A. Shelving: Exposed Closet, Storage Room, Utility Room shelving, made from one of the following materials, 3/4 inch (19 mm) thick:
1. Particleboard with solid-wood front edge.
  2. MDF with solid-wood front edge.

3. MDO softwood plywood with solid-wood edge.
4. Melamine-faced particleboard with applied-PVC front edge.
5. Wood boards as specified above for lumber trim for opaque finish.

- B. Shelf Cleats: 3/4-by-5-1/2-inch (19-by-140-mm) boards with hole and notch to receive clothes rods, as specified above for shelving .
- C. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; zinc-plated steel.
- D. Adjustable Shelf Brackets: BHMA A156.9, B04112; zinc-plated steel.
- E. Metal Clothes Rods: 1-5/16-inch- (33-mm-) diameter, chrome-plated-steel tubes .
- F. Metal Rod Flanges: Chrome-plated steel.

## 2.5 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Wood Species: Any closed-grain hardwood.
  1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (76 mm) wide.
  2. Wood Moisture Content: 4 to 9 percent.

## 2.6 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Installation Adhesive for Foam-Plastic Moldings: Product recommended for indicated use by foam-plastic molding manufacturer.
- D. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.
- E. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

## 2.7 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:

1. Interior standing and running trim, except shoe and crown molds.
  2. Wood-board paneling.
- B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
  1. Use concealed shims where necessary for alignment.
  2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
  4. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.



5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### 3.4 INSTALLATION OF INTERIOR TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
  1. Do not use pieces less than 24 inches (610 mm) long, except where necessary.
  2. Stagger joints in adjacent and related standing and running trim.
  3. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
  4. Use scarf joints for end-to-end joints.
  5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
  6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
  7. Install trim after gypsum-board joint finishing operations are completed.
  8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
  9. Fasten to prevent movement or warping.
  10. Countersink fastener heads on exposed carpentry work and fill holes.

### 3.5 INSTALLATION OF SHELVING AND CLOTHES RODS

- A. Cut shelf cleats at ends of shelves about 1/2 inch (13 mm) less than width of shelves and sand exposed ends smooth.
  1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
  2. Space fasteners not more than 16 inches (400 mm) o.c. Use two fasteners at each framing member or fastener location for cleats 4 inches nominal (89 mm actual) in width and wider.
  3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
  4. Remove adhesive that is squeezed out after fastening shelf cleats in place.
- B. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches (800 mm) o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches (300 mm) o.c.

- D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches (900 mm) o.c. and within 6 inches (150 mm) of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.
  - 1. Install shelves, fully seated on cleats, brackets, and supports.
  - 2. Fasten shelves to cleats with finish nails or trim screws, set flush.
  - 3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
- F. Install rod flanges for rods as indicated.
  - 1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
  - 2. Install rods in rod flanges.

### 3.6 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
  - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

### 3.7 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

### 3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 23

## SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 12 36 23.13 "Plastic-Laminate-Clad Countertops."
3. Section 12 36 23.16 "Solid-Surfacing Countertops."

#### 1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Miscellaneous materials.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
5. Apply WI Certified Compliance Program label to Shop Drawings.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
  - 1. Manufacturer's Certification: Licensed participant in WI's Certified Compliance Program.
- B. Installer Qualifications: Licensed participant in WI's Certified Compliance Program.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 20 and 50 percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for

trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide certificates from WI certification program indicating that woodwork and installation complies with requirements of grades specified.
  - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Type of Construction: Frameless.
- C. Door and Drawer-Front Style: Flush overlay.
- D. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Formica Corporation.
    - b. Laminart LLC.
    - c. Pionite (Panoram Industries International, Inc.)
    - d. Wilsonart LLC.
    - e. Or equal.
- E. Cabinet Liner: NEMA LD-3 Grade CLS.
- F. Exposed Surfaces:
  - 1. Plastic-Laminate Grade: HGS for countertops. VGS for vertical surfaces.
  - 2. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
- G. Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels (melamine).



- a. Edges of Thermally Fused Laminate Panel Shelves: PVC or ABS edge banding.
  - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.
2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.
- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  1. As selected by Architect from laminate manufacturer's full range in the following categories:
    - a. Solid colors, matte finish.
    - b. Solid colors with core same color as surface, matte finish.
    - c. Wood grains, matte finish.
    - d. Patterns, matte finish.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Wood Moisture Content: 4 to 9 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
  2. Particleboard (Medium Density): ANSI A208.1, Grade M-2-Exterior Glue.
  3. Softwood Plywood: DOC PS 1, medium-density overlay.
  4. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ISO 4586.

## 2.3 CABINET HARDWARE AND ACCESSORIES

- A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- E. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- G. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
- H. Drawer Slides: ANSI/BHMA A156.9.
  - 1. Standard Duty (Grade 1 and Grade 2): Side mount.
    - a. Type: Full extension.
    - b. Material: Galvanized steel ball bearing slides.
    - c. Motion Feature: Soft close dampener.
  - 2. General-purpose drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide 75 lb (34 kg) load capacity.
- I. Door Locks: ANSI/BHMA A156.11, E07121.
- J. Drawer Locks: ANSI/BHMA A156.11, E07041.
- K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- L. Grommets for Cable Passage: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Color: As selected by Architect from manufacturer's standard color selections.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
  - 1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
  - 2. Satin Stainless Steel: ANSI/BHMA 630.

- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

## 2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.5 FABRICATION

- A. Grade: North American Architectural Woodwork Standards (NAAWS) Custom Grade.
- B. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
  - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. -in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

### 3.2 INSTALLATION

- A. Install all work in conformance with the North American Architectural Woodwork Standards, latest edition.
  - 1. Installation shall conform to the NAAWS grade of the items being installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

### 3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through WI's Certified Compliance Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
  - 1. Inspection entity is to prepare and submit report of inspection.

### 3.4 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 41 16

## SECTION 06 64 00 - PLASTIC PANELING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring for installing plastic paneling.
2. Section 06 42 19 "Plastic-Laminate-Faced Wood Paneling."
3. Section 10 26 00 "Wall and Door Protection" for corner guards installed over plastic paneling.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Glasteel.
  - b. Marlite, Inc.
  - c. Nudo.
  - d. Or equal.
2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 25 or less.
  - b. Smoke-Developed Index: 450 or less.
3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).



4. Surface Finish: Molded pebble texture .
5. Color: As selected by Architect from manufacturer's full range.

## 2.2 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard aluminum extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
  1. Finish: Satin anodized, or powder coat finish in same color as panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Adhesive: As recommended by plastic paneling manufacturer.
- D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
  1. Mark plumb lines on substrate at panel joint locations for accurate installation.

2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

### 3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
  1. Drill oversized fastener holes in panels and center fasteners in holes.
  2. Apply sealant to fastener holes before installing fasteners.
- D. Install trim accessories with adhesive .
- E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

## SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Sheet waterproofing.
2. Molded-sheet drainage panels.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

#### 1.5 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

## 1.6 WARRANTY

### A. Manufacturer's Warranty:

1. Waterproofing Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

- a. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

### 2.2 SHEET WATERPROOFING

- A. Modified Bituminous Sheet Waterproofing: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Carlisle Coatings & Waterproofing Inc.
- b. GCP Applied Technologies Inc.
- c. Soprema, Inc.
- d. W. R. Meadows, Inc.
- e. Or equal.

2. Physical Properties:

- a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D412, Die C, modified.
- b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
- c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
- d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C836/C836M.
- e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E154/E154M.

- f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
  - g. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
  - h. Hydrostatic-Head Resistance: 200 feet (60 m) minimum; ASTM D5385.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

## 2.3 ACCESSORIES

- A. Furnish accessory materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  - 1. Furnish liquid-type accessory materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by sheet waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm), predrilled at 9-inch (229-mm) centers.
- G. Protection Course, Asphaltic: ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
- H. -reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
  - 1. Thickness: Nominal 1/8 inch (3 mm) for vertical applications; 1/4 inch (6 mm) elsewhere.
  - 2. Adhesive: Rubber-based solvent type recommended by waterproofing manufacturer for protection course type.

## 2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. (112 to 261 L/min. per m).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing Inc.; CCW Miradrain 2000.
    - b. GCP Applied Technologies Inc.; Hydroduct 220.
    - c. W. R. Meadows, Inc.; Mel-Drain 5035-B
    - d. Or equal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
  - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
  - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections.
- E. Fill form tie holes, honeycomb, aggregate pockets, holes, and other voids.



- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D4258.
  - 1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).
- G. Corners: Prepare, prime, and treat inside and outside corners in accordance with manufacturer's instructions.
  - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
    - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

### 3.3 INSTALLATION OF SHEET WATERPROOFING

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Seal edges of sheet waterproofing terminations with mastic.
- F. Roll waterproofing membrane to firmly adhere to substrate. Roll seams and terminations.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

H. Immediately install protection course with butted joints over waterproofing membrane.

1. Molded-sheet drainage panels may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

### 3.4 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

### 3.5 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 13 26

## SECTION 07 14 16 - COLD FLUID-APPLIED WATERPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Polyurethane waterproofing.
2. Protection course.
3. Molded-sheet drainage panels.

B. Related Requirements:

1. Section 07 18 00 "Traffic Coatings" for exposed, fluid-applied membrane with an integral wearing surface.
2. Section 09 30 13 "Ceramic Tiling" for fluid-applied waterproof membranes beneath ceramic tiles.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings:

1. Indicate locations and extent of waterproofing.
2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
3. Include setting drawings indicating layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
  - 1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
  - 2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

#### 1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 SOURCE LIMITATIONS

- A. Obtain waterproofing materials, from single source and from single manufacturer.

#### 2.2 POLYURETHANE WATERPROOFING

- A. Single component, high solids, modified polyurethane, or modified polymer, ASTM C 836/C 836M and coal-tar free, formulated for application to damp and green concrete.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing Inc.; Miraseal
    - b. Neogard; Hempel Group; 7401 (Hempel 47KJB).
    - c. Pacific Polymers; a Holcim brand; Elasto-Deck BT, Type II (Vertical).
    - d. Tremco Incorporated; Tremproof 250 GC.
    - e. Or equal.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated.
- C. Sheet Flashing: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene.
  - 1. Adhesive: Manufacturer's recommended contact adhesive.
- D. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
- E. Elastomeric Detail Sheet: Blended thermoset elastomeric sheet reinforced with polyester woven scrim.
- F. Metal Termination Bars: Waterproofing manufacturer's standard aluminum or stainless steel termination bar, with stainless steel fasteners.
- G. Termination Mastic: Waterproofing manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade, with recommended glass-fiber-mesh tape.
- H. Joint Sealant: Single component; ASTM C920, Type S, Class 25 or greater, Grade NS, polyurethane sealant compatible with waterproofing, or multi-component polyurethane sealant; ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and Grade P for deck applications; Use NT exposure; and as recommended by manufacturer for substrate and joint conditions.
  - 1. Backer Rod: Closed-cell polyethylene foam.

## 2.4 PROTECTION COURSE

- A. Protection Course: Waterproofing manufacturer's standard protection course material recommended for application.

## 2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing laminated to one side of the core and a polymeric film bonded to the other side;

and with a vertical flow rate through the core of 9 to 21 gpm per ft. (112 to 261 L/min. per m).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Carlisle Coatings & Waterproofing Inc.; CCW Miradrain 2000.
  - b. Mapei; Mapedrain 20.
  - c. Tremco Incorporated; Tremdrain 1000 PF.
  - d. Or equal.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
  2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

#### 3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C1471/C1471M.



- B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

### 3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.
  - 1. Comply with ASTM C1193 for joint-sealant installation.
  - 2. Apply bond breaker on sealant surface, beneath preparation strip.
  - 3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches (150 mm) wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.
- B. Install sheet flashing and bond to wall substrates where required in accordance with waterproofing manufacturer's written instructions.
  - 1. Extend sheet flashings for 4 inches (100 mm) onto perpendicular surfaces and items penetrating substrate.

### 3.5 INSTALLATION OF WATERPROOFING

- A. Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C1471/C1471M.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.
- D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
  - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 90 mils (2.25 mm).
  - 2. Apply waterproofing to prepared wall terminations and vertical surfaces.
  - 3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
- E. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

- F. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
  - 1. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.
  - 2. Molded-sheet drainage panels may be used in place of a separate protection course for vertical applications when approved in writing by waterproofing manufacturer.

### 3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
  - 1. For vertical applications, install protection course before installing drainage panels.

### 3.7 PROTECTION

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 07 14 16

## SECTION 07 19 00 - WATER REPELLENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Penetrating water repellents.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Penetrating water repellents.

B. Product Data Submittals:

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.
3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

#### 1.3 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. Mockups: Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Locate mockups in locations that enable viewing under same conditions as the completed Work.
  - a. Size: 25 sq. ft. (2.3 sq. m) each.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.4 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied in accordance with manufacturers' written instructions and warranty requirements:

#### 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Performance: Water repellents must meet the following performance requirements as determined by testing on manufacturer's standard substrates representing those indicated for this Project.
- B. Water Absorption: Minimum 80 percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested according to the following:
  1. Cast-in-Place Concrete: ASTM C642.
  2. Precast Concrete: ASTM C642.
  3. Cast Stone: ASTM C1195.
  4. Concrete Masonry Units: ASTM C140.
  5. Clay Brick: ASTM C67.
  6. Natural Stone: ASTM C97/C97M.
  7. Portland Cement Plaster (Stucco): ASTM D6532.
- C. Water-Vapor Transmission: Comply with one or both of the following:
  1. Maximum 10 percent reduction in water-vapor transmission of treated compared to untreated specimens, in accordance with ASTM E96/E96M.
- D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate of treated compared to untreated specimens, in accordance with ASTM E514/E514M.

- E. Durability: Maximum 5 percent loss of water-repellent performance after 1500 hours of weathering in accordance with ASTM G154 compared to water-repellent-treated specimens before weathering.

## 2.2 PENETRATING WATER REPELLENTS

- A. Penetrating Low-VOC Silane/Siloxane-Blend, or Acrylic Water Repellent: Clear, low gloss (satin).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Euclid Chemical Company (The); Chemstop WB Regular (dense surfaces), Heavy Duty (porous surfaces).
    - b. Rustoleum; Seal Krete Original.
    - c. Rustoleum; OKON S-40.
    - d. W.R. Meadows Decra-Seal Natural.
    - e. Or equal.
  - 2. VOC Content: <50 g/L.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
  - 1. Verify that surfaces are clean and dry in accordance with water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
  - 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
  - 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level in accordance with water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, in accordance with repellent manufacturer's written instructions.

- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product in accordance with water-repellent manufacturer's written instructions.
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
  - 1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

### 3.3 APPLICATION OF WATER REPELLENTS

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply coating of water repellent on surfaces to be treated using 15 psi- (103 kPa-) pressure spray with a fan-type spray nozzle to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.
- D. roject conditions.

### 3.4 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Comply with manufacturer's written cleaning instructions.



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END OF SECTION 07 19 00

## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Glass-fiber board insulation.
3. Mineral-wool blanket insulation.
4. Mineral-wool board insulation.
5. Spray-applied cellulosic insulation.

B. Related Requirements:

1. Section 07 22 00 "Roof and Deck Insulation" for thermal insulation under metal roof panels.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Glass-fiber blanket insulation.
2. Glass-fiber board insulation.
3. Mineral-wool blanket insulation.
4. Mineral-wool board insulation.
5. Spray-applied cellulosic insulation.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than 25 and 450 when tested in accordance with ASTM E84.
- B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.
- C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

- D. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

## 2.2 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
- B. Glass-Fiber Blanket Insulation, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

## 2.3 GLASS-FIBER BOARD INSULATION

- A. Glass-Fiber Board Insulation, Unfaced: ASTM C612, Type IA; unfaced, passing ASTM E136 for combustion characteristics.

## 2.4 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

## 2.5 MINERAL-WOOL BOARD INSULATION

- A. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.
  - 1. Nominal Density: 8 lb/cu. ft. (128 kg/cu. m).
- B. Mineral-Wool Board Insulation, Type II, Unfaced: ASTM C612, Type II; passing ASTM E136 for combustion characteristics.

## 2.6 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Self-Supported, Spray-Applied Cellulosic Insulation : ASTM C1149, Type II (materials containing a dry adhesive activated by water during installation; intended only for enclosed or covered applications), chemically treated for flame-resistance, processing, and handling characteristics.

## 2.7 ACCESSORIES

- A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

#### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

#### 3.3 INSTALLATION OF CAVITY-WALL INSULATION

- A. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches (100 mm) from each corner of board insulation, at center of board, and as recommended by manufacturer.
  1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
  2. Press units firmly against inside substrates.

### 3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  - 5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  - 6. For wood-framed construction, install blankets in accordance with ASTM C1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
- C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions.
  - 1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
  - 2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

### 3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

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END OF SECTION 07 21 00



## SECTION 07 22 00 – ROOF AND DECK INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Rigid roof insulation composite panel.

B. Related Requirements:

1. Section 07 21 00 "Roof and Deck Insulation" for thermal insulation, not a part of roof assembly.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Rigid roof insulation composite panel.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics (polyiso foam core only): Maximum flame-spread and smoke-developed indexes less than 75 and 450 when tested in accordance with ASTM E84.

#### 2.2 RIGID ROOF INSULATION COMPOSITE PANEL

#### 2.3 F INSULATION COMPOSITE PANEL

- A. ASTM C1289 Type V, Grade 2 (20 psi), 48 by 96 inches, incorporates APA-TECO Rated Exposure 1 OSB.

1. 7/16 inch thick OSB panels with rabbetted edges to allow for expansion and contraction of the wood. The foam edges shall be installed tightly to achieve thermal integrity across the entire roof deck.
2. Thickness of panel as indicated on Drawings.

3. Manufactured with NexGen Chemistry: Contains no CFCs, HFCs, HCFCs is Zero ODP, EPA compliant, and has virtually no GWP.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install rigid roof insulation composite panels using manufacturer's recommended fasteners.

END OF SECTION 07 22 00

## SECTION 07 41 13.13 - FORMED METAL ROOF PANELS

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Exposed-fastener, lap-seam, metal roof panels.
2. Concealed-fastener, perforated soffit panels.

#### 1.2 ACTION SUBMITTALS

##### A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

1. Exposed-fastener, lap-seam, metal roof panels.
2. Concealed-fastener, perforated soffit panels.

##### B. Shop Drawings:

1. Include fabrication and installation layouts of metal roof and soffit panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

##### C. Samples: For each type of metal roof and soffit panel indicated with factory-applied color finishes.

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.
2. Include similar Samples of trim and accessories involving color selection.

#### 1.3 QUALITY ASSURANCE

##### A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

#### 1.5 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
  - 1. Uplift Rating: UL 90.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 2.2 EXPOSED-FASTENER, LAP-SEAM, METAL ROOF PANELS

- A. Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- B. Corrugated-Profile, Exposed-Fastener Metal Roof Panels: Formed with alternating curved ribs spaced at 2.67 inches (68 mm) o.c. across width of panel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Western States Metal Roofing. [www.westernstatesmetalroofing.com](http://www.westernstatesmetalroofing.com).
    - b. AEP Span a brand of ASC Profiles LLC, a part of BlueScope.
    - c. Berridge Manufacturing Company.
    - d. CENTRIA, a Nucor Brand.
    - e. MBCI; Cornerstone Building Brands.
    - f. Morin - A Kingspan Group Company.
    - g. Or equal.
  - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-

- coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Nominal Thickness: 0.034 inch (0.86 mm).
    - b. Exterior Finish: Two-coat fluoropolymer .
    - c. Color: As selected by Architect from manufacturer's full range.
  - 3. Panel Coverage: 34.67-inches (880 mm).
  - 4. Panel Height: As indicated on Drawings.
- C. Tapered-Rib-Profile, Exposed-Fastener Metal Roof Panels: Formed with raised, trapezoidal ribs.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Western States Metal Roofing. [www.westernstatesmetalroofing.com](http://www.westernstatesmetalroofing.com).
    - b. AEP Span a brand of ASC Profiles LLC, a part of BlueScope.
    - c. Berridge Manufacturing Company.
    - d. CENTRIA, a Nucor Brand.
    - e. MBCI; Cornerstone Building Brands.
    - f. Morin - A Kingspan Group Company.
    - g. Or equal.
  - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Nominal Thickness: 0.034 inch (0.86 mm) ].
    - b. Exterior Finish: Two-coat fluoropolymer.
    - c. Color: As selected by Architect from manufacturer's full range.
  - 3. Panel Coverage: 36 inches (914 mm).
  - 4. Panel Height: As indicated on Drawings.

## 2.3 CONCEALED-FASTENER, PERFORATED SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Morin - A Kingspan Group Company (Basis of Design).
    - b. Western States Metal Roofing. [www.westernstatesmetalroofing.com](http://www.westernstatesmetalroofing.com).



- c. AEP Span a brand of ASC Profiles LLC, a part of BlueScope.
  - d. Berridge Manufacturing Company.
  - e. CENTRIA, a Nucor Brand.
  - f. MBCI; Cornerstone Building Brands.
  - g. Or equal.
2. Aluminum Sheet: Coil-coated sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
  - a. Thickness: 0.040 inch (1.02 mm).
  - b. Surface: Smooth, flat finish.
  - c. Exterior Finish: Two-coat fluoropolymer.
  - d. Color: As selected by Architect from manufacturer's full range.
3. Profile: As indicated on Drawings.
4. Panel Width: 12-inches.
5. Panel Depth: 1-1/2-inches.
6. Panel Joint: Tongue and groove interlock.
7. Panel Attachment: Concealed floating clip and fastener.
8. Perforation pattern:

## 2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
  1. Thermal Stability: Stable after testing at 220 deg F (111 deg C); ASTM D1970.
  2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D1970.
- B. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

## 2.5 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings,

sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal, and finish as metal panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.
- D. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
- E. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- F. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
  2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
  3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.6 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance

requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

## 2.7 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Steel Panels and Accessories:
1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  2. metal surfaces to comply with coating and resin manufacturers' written instructions.
  3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
  - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
  - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

### 3.3 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
  - 1. Apply over the roof area indicated below:

- a. Roof perimeter for a distance up from eaves of 24 inches (610 mm) beyond interior wall line.
  - b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (152 mm).
  - c. Rake edges for a distance of 18 inches (460 mm).
  - d. Hips and ridges for a distance on each side of 12 inches (305 mm).
  - e. Roof-to-wall intersections for a distance from wall of 18 inches (460 mm).
  - f. Around d penetrating elements for a distance from element of 18 inches (460 mm).
- B. Felt Underlayment: Apply at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).
1. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
- C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

### 3.4 INSTALLATION OF METAL ROOF PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
  2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air or water-resistive barriers and flashings that are concealed by metal panels are installed.
  3. Install screw fasteners in predrilled holes.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Install flashing and trim as metal panel work proceeds.
  6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Use stainless steel fasteners.

2. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- C. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
  2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  5. Flash and seal panels with weather closures at perimeter of all openings.
- D. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal pane
- E. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing an
  2. trim to fit substrates and achieve waterproof performance.
  3. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- F. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c.



using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

- G. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
  - 1. Connect downspouts to underground drainage system indicated.
- H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

### 3.5 INSTALLATION OF METAL SOFFIT PANELS

- A. Install metal soffit panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Flash and seal metal panels at perimeter of all openings. Fasten with corrosion resistant clips and self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
- B. Fasteners: Concealed clips and stainless steel fasteners.

### 3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

### 3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13.13

## SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Trapezoidal-rib, seamed joint, standing seam metal roof panels, with related metal trim and accessories.
- B. Related Requirements:
  - 1. Section 06 16 00 "Sheathing" for plywood sheathing to repair/replace existing damaged plywood substrate under metal roof panels.
  - 2. Section 07 22 00 "Roof and Deck Insulation" for thermal insulation under metal roof panels.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with City, Architect, City's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to roof sheathing, insulation and underlayment.
  - 4. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
  - 5. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 6. Review structural loading limitations of deck and roof joists during and after roofing.
  - 7. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
  - 8. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 9. Review temporary protection requirements for metal panel systems during and after installation.
  - 10. Review procedures for repair of metal panels damaged after installation.
  - 11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
  - 1. Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, roof accessories, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.
    - a. Indicate points of supporting structure that must coordinate with metal panel system installation.
    - b. ation.
    - c. Include data indicating compliance with performance requirements.
    - d. Include structural data indicating compliance with requirements of authorities having jurisdiction.
- C. Samples: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.
  - 1. Include similar Samples of trim and accessories involving color selection.

### 1.4 QUALITY ASSURANCE

- A. Single Source Qualifications: Provide metal roof panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under International Accreditation Service, Inc. (IAS) AC 472 Part B.
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.
- C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope..
  - 1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 25 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 STANDING-SEAM METAL ROOF PANELS

A. Mechanically Seamed, Concealed Fastener, Trapezoidal Seam Metal Roof Panels: Structural metal roof panel consisting of formed metal sheet with raised trapezoidal ribs at panel edges, installed by lapping and mechanically interconnecting edges of adjacent panels, and attaching panels to supports using concealed clips and fasteners in a weathertight installation.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. MBCI Metal Roof and Wall Systems; Cornerstone Building Brands; Double-Lok. (Basis of Design).
- b. Metal Sales MFG CORP.
- c. Berridge Manufacturing Company.
- d. CENTRIA, a Nucor Brand.
- e. Fabral; a brand of Flack Global Metals.
- f. Morin - A Kingspan Group Company.
- g. Or equal.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.

- a. Nominal Thickness: 24 gage coated thickness.
- b. Panel Surface: Smooth with minor ribs in pan.
- c. Exterior Finish: Fluoropolymer two-coat system.
- d. Color: As indicated on Drawings.
- e. Panel Width: 18 inches (457 mm).
- f. Panel Seam Height: 3 inch (76 mm).
- g. Joint Type: Double folded.



## 2.3 ACCESSORIES

- A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings, in profiles as indicated. Provide required fasteners, closure strips, splice plates, support plates, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.
- C. Two Piece Floating Clips: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- D. Panel Fasteners: Self-tapping screws and other acceptable corrosion-resistant fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply fasteners with EPDM or neoprene gaskets, and heads matching color of metal panels by means of factory-applied coating.
- E. eans of factory-applied coating.

## 2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils (1 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D1970.
  - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D1970.
  - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle WIP Products; a brand of Carlisle Construction Materials; WIP 300HT.
    - b. GCP Applied Technologies Inc.; Grace Ice & Water Shield HT.
    - c. Henry Company; a Carlisle company; Blueskin PE200HT.
    - d. Protecto Wrap Company; Jiffy Seal Ice & Water Guard HT.
    - e. Or equal.

## 2.5 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating

designation or ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. al panels.
- E. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 120-inch (3048 mm) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.
- F. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
- G. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
  - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
  - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

## 2.6 FABRICATION

- A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept factory applied sealant providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.
- C. Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

## 2.7 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.
- C. Interior Finish: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.
- D. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- F. contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
  2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:
    - a. 1/4 inch (6 mm) in 20 foot (6.1 m) in any direction.
    - b. 3/8 inch (9 mm) over any single roof plane.
  3. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.
  4. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
- B. Flashings: Provide flashings as required to complete metal roof panel system. Install in accordance with Section 07 62 00 "Sheet Metal Flashing and Trim" and approved shop drawings.

### 3.3 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

### 3.4 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

- A. Mechanically-Seamed, Trapezoidal Standing Seam Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to supports using clips, screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.
  1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
  2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
  3. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
  4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- C. Accessory Installation: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Provide for thermal expansion. Coordinate installation with flashings and other components.
  1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
  2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
  3. Provide concealed fasteners except where noted on approved shop drawings.
  4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
- D. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- E. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1-inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
  2. Connect downspouts to underground drainage system indicated.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.
- G. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.
1. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

### 3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13.16



## SECTION 07 46 46 - FIBER-CEMENT SIDING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fiber-cement siding.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

#### 1.2 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Fiber-cement siding.

#### 1.4 WARRANTY

A. Product Warranty: Limited, non-pro-rated product warranty.

1. HardiPanel HZ5 vertical siding for 30 years.

B. Product Warranty: Limited, product warranty.

1. HardieTrim HZ and HZ5 boards for 15 years.

C. Finish Warranty: Limited product warranty against manufacturing finish defects.

1. When used for its intended purpose, properly installed and maintained according to James Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of

purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

- D. Workmanship Warranty: Application limited warranty for 2 years.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

### 2.2 FIBER-CEMENT SIDING

- A. Fiber-Cement Siding: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. James Hardie Building Products, Inc.; Hardie Panel Vertical Siding.
- b. Or equal.

- B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

- C. Nominal Thickness: Not less than 5/16 inch (8 mm).

- D. Panel Texture: 48-inch- (1200-mm-) wide sheets with smooth texture.

- E. Factory Priming: Manufacturer's standard acrylic primer.

### 2.3 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

- B. Flashing: Provide galvanized steel flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

- C. Reveals: Aluminum channel screed, non-vented, 6063-T5 alloy, Fry Reglet Corp. or equal.
  - 1. Size: As indicated on Drawings.
  - 2. Finish: Painted to match color and sheen of fiber cement siding.
- D. Fasteners:
  - 1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
  - 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch (6 mm), or three screw-threads, into substrate.
  - 3. For fastening fiber cement, use hot-dip galvanized or stainless steel fasteners.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

#### 3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
  - 1. Do not install damaged components.
  - 2. Install fasteners no more than 16 inches o.c.
- B. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

#### 3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Nonstaining silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Immersible joint sealants.
  - 4. Mildew-resistant joint sealants.
  - 5. Butyl joint sealants.
  - 6. Latex joint sealants.
  - 7. Concrete paving joint sealants.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.

#### 1.3 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Nonstaining Warranty: Manufacturer warrants that nonstaining silicone sealant will not cause porous substrates to discolor or change their appearance due to fluid migration and will maintain a watertight weatherseal for the warranty period stated below.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- D. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
  1. Architectural sealants shall have a VOC content of 250 g/L or less.
  2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
  3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
  4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

### 2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



- a. Dow Corning Corporation; 790 Silicone Building Sealant.
  - b. GE Construction Sealants; SCS2700 Silpruf LM.
  - c. Pecora Corporation; 890 (NST).
  - d. Sika Corporation; Sikasil WS-290.
  - e. Tremco Incorporated; Spectrem 1.
  - f. Or equal.
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation; 756 SMS Building Sealant.
    - b. GE Construction Sealants; Silpruf NB.
    - c. Pecora Corporation; 864 (NST) or 895 (NST).
    - d. Sika Corporation; Sikasil WS-295.
    - e. Tremco Incorporated; Spectrem 2.
    - f. Or equal.
    - g.

## 2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation - Construction Systems; MasterSeal NP 1 (formally Sonneborn Sonolastic NP 1)
    - b. Bostik, Inc.; 915
    - c. Pecora Corporation; DynaTrol 1-XL
    - d. Sika Corporation; Sikaflex 1a or Sikaflex 201
    - e. Tremco Incorporated; Vulkem 116 or Dymonic
    - f. Or equal.
- B. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation - Construction Systems; MasterSeal NP 2 (formally Sonneborn Sonolastic NP 2)

- b. Pecora Corporation; DynaTrol II for traffic applications, install per manufacturer's technical bulletin.
  - c. Tremco Incorporated.; Dymeric 240 or Dymeric 240 FC
  - d. Or equal.
- 2.
- C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pecora Corporation; DynaTrol II for traffic applications, install per manufacturer's technical bulletin.
    - b. Tremco Incorporated.; Dymeric 240 or Dymeric 240 FC
    - c. Or equal.
  - 2.

## 2.4 IMMERSIBLE JOINT SEALANTS

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C 1247, Class 2; tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Uses T, NT, and I.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Basf: MasterSeal NP 1 (formerly Sonneborn Sonolastic NP 1)
    - b. Bostik: Chem-Calk 2020
    - c. Euclid; Eucolastic 1SL
    - d. Tremco Incorporated.; Vulkem 45 SSL
    - e. Or equal.
- C. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 35, Uses T, NT, and I.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Basf: MasterSeal NP-1 (formerly Sonneborn Sonolastic NP 1)
    - b. Bostik: Chem-Calk 955 SL
    - c. Tremco Incorporated.; Vulkem 45 SSL.
    - d. Or equal.
  - 2.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation; 786 Mildew Resistant of 999-A Silicone Building & Glazing Sealant.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; GE SCS1700 Sanitary.
    - c. Sika Corporation; Sikasil GP-101.
    - d. Tremco Incorporated.; Tremsil 200 Sanitary.
    - e. Or equal.

## 2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bostik, Inc.; Chem-Calk 300.
    - b. Pecora Corporation; BC-158
    - c. Tremco; General Purpose Butyl Sealant
    - d. Or equal.

## 2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bostik, Inc.; Chem-Calk 600
    - b. May National Associates, Inc.; a subsidiary of Sika Corporation.; Bondaflex 600 or Bondaflex Sil-A 700, as recommended by the manufacturer for the specific application.
    - c. Pecora Corporation; AC-20 +
    - d. Tremco Incorporated.; Tremflex 834

- e. Or equal.
- 2.

## 2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. sealants to joint substrates.
- D. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. , surface dirt, and frost.
  3. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  4. Remove laitance and form-release agents from concrete.
  5. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- D. or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:



- a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
    - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  3. Inspect tested joints and report on the following:
    - a. Whether sealants filled joint cavities and are free of voids.
    - b. Whether sealant dimensions and configurations comply with specified requirements.
    - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
  4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
  5. ed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
  6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.
- C. t failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Control and expansion joints in brick pavers.
    - b. Isolation and contraction joints in cast-in-place concrete slabs.
    - c. Joints between plant-precast architectural concrete paving units.
    - d. Joints in stone paving units, including steps.
    - e. Tile control and expansion joints.
    - f. Joints between different materials listed above.
    - g. .
    - h. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
  - 1. Joint Locations:
    - a. Joints in pedestrian plazas.
    - b. Joints in swimming pool decks.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, Immersible, S, NS, 50, T, NT, I: .
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
- b. Joints between plant-precast architectural concrete units.
- c. Control and expansion joints in unit masonry.
- d. Joints in dimension stone cladding.
- e. Joints in glass unit masonry assemblies.
- f. Joints in exterior insulation and finish systems.
- g. Joints between metal panels.
- h. Joints between different materials listed above.
- i. Perimeter joints between materials listed above and frames of doors windows and louvers.
- j. Control and expansion joints in ceilings and other overhead surfaces.
- k. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

- a. Isolation joints in cast-in-place concrete slabs.
- b. Control and expansion joints in stone flooring.
- c. Control and expansion joints in brick flooring.
- d. Control and expansion joints in tile flooring.
- e. .
- f. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT: .

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

- a. Control and expansion joints on exposed interior surfaces of exterior walls.
- b. Tile control and expansion joints.
- c. Vertical joints on exposed surfaces of concrete.
- d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
    - c. .
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Acrylic latex.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. .
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
    - a. Aluminum thresholds.
    - b. Sill plates.
    - c. .
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Butyl-rubber based.
  3. Joint-Sealant Color: As indicated by manufacturer's designations As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

## SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
  - 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

#### 1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

#### 1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.
  - 7. Details of accessories.
  - 8. Details of moldings, removable stops, and glazing
  - 9. Details of conduit and preparations for power, signal, and control systems.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door; ASSA ABLOY.
  - 2. Curries Company; ASSA ABLOY.
  - 3. Custom Metal Products.
  - 4. Fleming Door Products Ltd.; Assa Abloy Group Company.
  - 5. Republic Doors and Frames; [www.republicdoor.com](http://www.republicdoor.com).
  - 6. Or equal.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

### 2.3 INTERIOR STANDARD DOORS AND FRAMES

- A. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2..
  - 1. Physical Performance: Level B according to SDI A250.4.
  - 2. Doors:



- a. Type: As indicated in the Door and Frame Schedule.
  - b. Thickness: 1-3/4 inches (44.5 mm).
  - c. Face: Uncoated cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
  - d. Edge Construction: Model 1, Full Flush.
  - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
- a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
  - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

## 2.4 EXTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3..
- 1. Physical Performance: Level A according to SDI A250.4.
  - 2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches (44.5 mm).
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.30 mm), with minimum A40 (ZF120) coating.
    - d. Edge Construction: Model 1, Full Flush...
    - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion..
  - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.5 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.
  - 3. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
    - b. Construction: Full profile welded.

4. Exposed Finish: Prime.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
  1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
  2. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. ,Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
  1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

## 2.6 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
  1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- J. Glazing: Comply with requirements in Section 088000 "Glazing."
- K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
  - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
  - 3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
  - 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
  - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
  - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide

alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
  2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  4. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
      - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
      - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
    - b. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  5. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
  6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
  7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  3. Provide loose stops and moldings on inside of hollow-metal work.
  4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 NAAMM-HMMA 840.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. At fire-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - c. Install frames with removable stops located on secure side of opening. Install door silencers in frames before grouting.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
  - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
  - 5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.



1. Non-Fire-Rated Steel Doors:

- a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
- b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
- c. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
- d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

- 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

## SECTION 08 14 16 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
2. Light frames.

B. Related Requirements:

1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
2. Light frames.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory- finishing specifications.

#### 1.3 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature

between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 17 and 50 percent during remainder of construction period.

#### 1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Delamination of veneer.
    - b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
    - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
  - 2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection rating indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

#### 2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

#### 2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

- A. Interior Doors, Solid-Core Five-Ply Veneer-Faced:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lambton Doors.
  - b. Masonite Architectural.
  - c. Oregon Door.
  - d. Oshkosh Door Company.
  - e. VT Industries, Inc.
  - f. Or equal.
2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
3. ANSI/WDMA I.S. 1A Quality Grade: Custom.
4. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.
  - a. Species: Select white birch, Select red birch, Red oak, or White Oak.
  - b. Cut: Plain sliced (flat sliced).
  - c. Match between Veneer Leaves: Book match.
  - d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
  - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
  - f. Room Match:
    - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
    - 2) Provide door faces of compatible color and grain within each separate room or area of building.
  - g. Transom Match: Continuous match.
  - h. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling.
5. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
  - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
  - b. Fire-Rated Pairs of Doors:
    - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    - 2) Provide formed-steel edges and astragals with intumescent seals.

- a) Finish steel edges and astragals with baked enamel same color as doors.
    - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
  - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
    - 1) Screw-Holding Capability: 475 lbf (2110 N) in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:
- a. ANSI A208.1, Grade LD-2 particleboard.
    - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
    - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
- a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

## 2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.
  - 1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, [factory primed for paint] [with baked-enamel- or powder-coated] finish.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
  - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
  - 1. Locate hardware to comply with DHI-WDHS-3.
  - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
  - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
  - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
  - 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels:
  - 1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
  - 2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  - 3. Fabricate door and transom panels with full-width, solid-lumber[, rabbeted,] meeting rails.
  - 4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.

## 2.6 FACTORY PRIMING

- A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123 "Interior Painting."

## 2.7 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.



1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  2. Finish faces, all four edges, edges of cutouts, and mortises.
  3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Factory finish doors that are indicated on Drawings to receive transparent finish.
- D. Factory finish doors where indicated in schedules or on Drawings as factory finished.
- E. Transparent Finish:
1. ANSI/WDMA I.S. 1A Grade: Custom.
    - a. TR-8 UV Cured Acrylated Polyester/Urethane.
  2. Staining: As selected by Architect from manufacturer's full range.
  3. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
  2. Anchor frames to anchors or blocking built in or directly attached to substrates.

- a. Secure with countersunk, concealed fasteners and blind nailing.
  - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
- 1) For factory-finished items, use filler matching finish of items being installed.
- 3. Install fire-rated doors and frames in accordance with NFPA 80.
- 4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
  - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
  - 2. Machine doors for hardware.
  - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 4. Clearances:
    - a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
    - b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    - c. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    - d. Comply with NFPA 80 for fire-rated doors.
  - 5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
  - 6. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

END OF SECTION 08 14 16

## SECTION 08 31 13 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- B. Related Requirements:
  - 1. Section 07 72 00 "Roof Accessories" for roof hatches.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

#### 2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Acudor Products, Inc.
    - b. Babcock-Davis.
    - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - d. Karp Associates, Inc.
    - e. Or equal.

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: 24 inch by 24 inch.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Latch bolt, key operated.

B. Exterior Flush Access Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Babcock-Davis.
  - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - c. Karp Associates, Inc.
  - d. Nystrom, Inc.
  - e. Or equal.
2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick (50-mm-thick) fiberglass insulation.
3. Locations: Wall.
4. Door Size: 12 inch by 12 inch.
5. Stainless-Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, No. 4 finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Latch and Lock: Cam latch operated by handle, with keyed lock in handle.

## 2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Babcock-Davis.
  - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - c. Karp Associates, Inc.
  - d. Nystrom, Inc.
  - e. Or equal.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: 24 inch by 24 inch..
5. Fire-Resistance Rating: Not less than that of adjacent construction.

6. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-latching door hardware, operated by key.

## 2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- E. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
- F. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- G. Frame Anchors: Same material as door face.
- H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.



2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

## 2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless-Steel Finishes:
  1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
  2. Polished Finish: No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
    - a. Run grain of directional finishes with long dimension of each piece.
    - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

### 3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

## SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
3. Environmental Product Declaration: For each product.
4. Health Product Declaration: For each product.
5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

D. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
  - a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Delegated design engineer qualifications.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
  - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- B. Product Options: Information on Drawings and Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

#### 1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
    - c. Cracking, peeling, or chipping.
  - 2. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Arcadia, Inc.
  - 2. Kawneer Company, Inc.; Arconic Corporation.
  - 3. OldCastle BuildingEnvelope (OBE).
  - 4. YKK.
  - 5. Or equal.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- C. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m).

2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).
    - a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).
- G. Dynamic Water Resistance: No water leakage, when measured in accordance with AAMA 501.1-94 with a dynamic test pressure of 12PSF.
- H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- I. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
    - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.32 Btu/sq. ft. x h x deg F (0.55 W/sq. m x K) as determined in accordance with NFRC 100.
    - b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K) as determined in accordance with NFRC 100.
  2. Solar Heat-Gain Coefficient (SHGC):
    - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
    - b. Entrance Doors: SHGC of not more than 0.25 as determined in accordance with NFRC 200.
  3. Air Leakage:



- a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa) when tested in accordance with ASTM E283.
  - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
  - 2. Designed to carry gravity loads of glazing.

## 2.3 STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Arcadia, Inc.; TC670 Thermal (Basis of Design).
  - 2. Or equal.
- B. Framing Members and Accessories:
  - 1. 2-1/4 by 6-inch, thermally broken, captured offset glazed, screw spline, shear block, 4 sided gasketing.
  - 2. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6).
  - 3. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.
  - 4. Glazing Gasket (Silicone Compatible):
    - a. Compression-type design, replaceable, molded or extruded santoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
    - b. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## 2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Arcadia MS362 HD, or equal.

1. Door Construction: 1-3/4-inch (45 mm) overall thickness, with minimum 0.188-inch- (4.8-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3-1/2-inch (88 mm) nominal width.
3. Top Rail: 3-5/8-inch (92 mm).
4. Bottom Rail: Compliant with accessibility requirements; 10 inches (250 mm) minimum.
5. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
6. Finish: Match adjacent storefront framing finish.

## 2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.
  1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
  2. Opening-Force Requirements:
    - a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion.
    - b. Accessible Interior Doors: Not more than 5 lbf (22.2 N) to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
  1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
  2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Pivot Hinges: BHMA A156.4, Grade 1.
  1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.
- E. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
  2. Exterior Hinges: Stainless steel, with stainless steel pin.
  3. Quantities:
    - a. For doors up to 87 inches (2210 mm) high, provide three hinges per leaf.
    - b. For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide four hinges per leaf.
- F. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- G. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- H. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.
- I. Cylinders:
1. As specified in Section 08 71 00 "Door Hardware."
  2. BHMA A156.5, Grade 1.
    - a. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".
- J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- K. Operating Trim: BHMA A156.6.
- L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- M. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.
- N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- O. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
  2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- Q. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

- R. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

## 2.6 GLAZING

- A. Glazing: Comply with Section 08 80 00 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

## 2.7 MATERIALS

- A. Sheet and Plate: ASTM B209 (ASTM B209M).
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
  - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.

## 2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from exterior.

6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
  - D. Storefront Framing: Fabricate components for assembly using shear-block system, or screw-spline system.
  - E. Diverters shall be provided to collect water infiltration and divert from the interior of the system.
  - F. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance.
  - G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
    1. At interior and exterior doors, provide compression weather stripping at fixed stops.
  - H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
    1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
    2. At exterior doors, provide weather sweeps applied to door bottoms.
    3. Stiles and rails shall be tubular sections accurately joined, flush and hairline at corners with heavy concealed reinforcement brackets secured with machine bolts, with optional MIG weld. Exposed screws not permitted.
    4. Each door leaf equipped with an adjusting mechanism, located in the top rail near the lock stile.
  - I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
  - J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.
- 2.9 ALUMINUM FINISHES
- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

### 3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 08 80 00 "Glazing."

### 3.4 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.



### 3.5 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
  2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
  3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
    - c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
  4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

END OF SECTION 084113

## SECTION 08 51 13 - ALUMINUM WINDOWS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Aluminum windows; fixed, awning and sliding.

#### 1.2 COORDINATION

- A. Finish Matching: Coordinate all exposed exterior aluminum components and trim to ensure uniform and consistent color and appearance. Use products specified in this Section as a benchmark. Architect's decision will be final as to whether a proposed product matches.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Sample warranties.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver aluminum windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect aluminum windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle aluminum windows in a manner that prevents damage before, during, and after installation.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install aluminum windows outside of limits recommended in writing by manufacturer.

## 1.8 WARRANTY

- A. Manufacturer shall warrant against failure and/or deterioration of metals due to manufacturing process for a period of two years providing the product is installed in accordance with manufacturer's installation instructions and maintained in accordance with manufacturer's operations and maintenance manual.
- B. Insulated Glass Units: Factory glazed IGU: 10 years.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain aluminum windows from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
  - 1. Minimum Performance Class: CW.
  - 2. Minimum Performance Grade: PG80-AP.
- C. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
  - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
    - a. Fixed Windows: Not more than 0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K) .
    - b. Operable Windows: Not more than 0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K) .
  - 2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:
    - a. Fixed Windows: Not more than 0.28.
    - b. Operable Windows: Not more than 0.23 .
  - 3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of 45.
- D. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F (67 deg C) ambient; 180 deg F (100 deg C) material surfaces.

## 2.3 ALUMINUM WINDOWS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Arcadia, Inc. Architectural Products Division; CV200 Series (non thermal) Heavy Commercial Operable Windows.

2. Skyline Windows; DL97 series. Address: 220 East 138<sup>th</sup> Street, Bronx, NY 10451. Tel: (212) 491-3000. Fax: (212) 491-5630. Website: [www.skylinewindows.com](http://www.skylinewindows.com).

3. Or equal.

B. Commercial Operable Windows: Arcadia; CV200 Series (non thermal) Heavy Commercial Operable Windows, or equal.

1. Operating Types: Fixed, awning (in swing opening), and sliding.

2. Frame Depth: 2 inch (50 mm), unless indicated otherwise on Drawings.

## 2.4 MATERIALS

A. Extruded aluminum profiles shall be 6063-T6 alloy and temper (ASTM B 221 G.S. 10A-T6).

B. Framing members 0.125 minimum wall thickness.

C. Heavy-duty four bar hinges stainless steel only, with asymmetric end caps, and adjustable limit stops. Lock and latches cast white bronze, US-25D finish.

D. Weatherstrip EPDM bulb type conforming to ASTM D 2000 AA515 and keyed into extruded grooves.

E. Back glazing two-sided adhesive, 15 lb/ft<sup>3</sup> density, polyethylene tape. Glazing wedges EPDM or Santoprene.

F. Screens made of extruded aluminum frame and screened with either 18 x 14 aluminum or fiber mesh.

## 2.5 FABRICATION

A. Frame components mitered, reinforced extruded corner key, hydraulically crimped, and "cold welded."

B. Ventilator extrusions tubular, each corner mitered, reinforced extruded corner key, hydraulically crimped, and "cold welded."

C. Corners weather sealed with an elastomeric sealant.

D. Glass shall be four-sided, structural glazed with silicone.

E. Only factory glazing of the structural silicone shall be acceptable.

F. Design Requirements: Provides the appearance of an exterior butt-glazed system (zero sightline).

- G. Performance Requirements: Each assembly shall be tested by a recognized testing laboratory or agency in accordance with specified test methods.
1. Conformance to CW80 specifications in AAMA/NWWDA 101/I.S. 2.
  2. Air Infiltration: Accordance with ASTM E 283 at a static air pressure difference of 6.24 psf. Air infiltration shall not exceed .30 cfm per square foot. (0.30 measured on test No. T10-001).
  3. Water Resistance: Accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 12 psf. No water leakage.
  4. Uniform Load Structural: Operable when tested per ASTM E 330 at a static air pressure difference of 120 psf.
  5. Component testing: Accordance with procedures described in AAMA/NWWDA 101/I.S. 2-97.
  6. Forced Entry Resistance: Conform to CAWM 301-.
  7. Thermal Movements: Allow thermal movement resulting from maximum change (range) in ambient temperature of 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, air and weather barriers, and other built-in components to ensure weathertight window installation.



- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in the manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight installation.
- C. Install windows and components to drain water passing joints and condensation to the exterior.
- D. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.3 CLEANING AND PROTECTION

- A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 51 13

## SECTION 08 51 23.13 - HOT-ROLLED STEEL WINDOWS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Hot-rolled steel windows.

B. Related Requirements:

1. Section 08 51 13 "Aluminum Windows" for aluminum windows.
2. Section 09 91 23 "Interior Painting" and Section 09 91 13 "Exterior Painting" for on-site painting of factory prime-coated windows.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings:

1. Plans, elevations, sections, and details.
2. Detail attachments to other work, and between units, if any.
3. Hardware and required clearances.
4. Mullion details, including reinforcement and stiffeners.
5. Munton details.
6. Flashing details.
7. Glazing details.
8. Accessories.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sample warranties.

#### 1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of hot-rolled steel windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:
  - a. Window: Three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SOURCE LIMITATIONS

- A. Obtain hot-rolled steel windows from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. SWI Standards: Comply with applicable requirements in SWI's "Architect's Guide to Steel Windows and Doors" and "Specifications - Solid Hot Rolled Sections," except where more stringent requirements are indicated.
- B. Structural Wind Loads: As indicated on Drawings.
- C. Deflection Limits: Design glass framing system to limit deflection of glass edges in a direction perpendicular to glass plane to less than 1/175 of glass-edge length for each individual glazing light or 3/4 inch (19 mm), whichever is less, at design pressures.
- D. Structural: Test in accordance with ASTM E330/E330M as follows:
  1. When tested at positive and negative wind-load design pressures, hot-rolled steel windows do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Air Leakage for Weather-Stripped Sash: Not more than 0.37 cfm/ft. (0.18 L/s/m) of sash crack length at a differential pressure across the windows of 6.24 lbf/sq. ft. (298 Pa) when tested in accordance with ASTM E283/E283M.
- F. Air Leakage for Non-Weather-Stripped Sash: Not more than 1.0 cfm/ft. (0.47 L/s/m) of sash crack length at a differential pressure across the windows of 1.56 lbf/sq. ft. (75 Pa) when tested in accordance with ASTM E283/E283M.
- G. Water Penetration for Weather-Stripped Sash: No leakage for 15 minutes when window is subjected to a rate of flow of 5 gal./h/sq. ft. (0.05 L/s/sq. m) with a differential pressure across the window of 2.86 lbf/sq. ft. (137 Pa) when tested in accordance with ASTM E331.

- H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
  - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
    - a. Fixed Windows: Not more than 0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K).
    - b. Operable Windows: Not more than 0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K).
  - 2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:
    - a. Fixed Windows: Not more than 0.28.
    - b. Operable Windows: Not more than 0.23.
  - 3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of 45.
- I. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F (67 deg C) ambient; 180 deg F (100 deg C) material surfaces.
- J. Crack Tolerances: Test each type and size of required window unit, with sash closed and locked, for compliance with tolerances indicated in SWI's "Architect's Guide to Steel Windows and Doors" and "Specifications - Solid Hot Rolled Sections."
- K. Forced-Entry Resistance: Comply with Performance Grade 40 at 300 pounds when tested in accordance with ASTM F588.

## 2.3 HOT-ROLLED STEEL WINDOWS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Arcadia Inc.; Integra Series MW-40.
  - 2. Hope's Windows, Inc.; Landmark 175 Series.
  - 3. Torrance Steel Window Co., Inc.; 2000 Series.
  - 4. Or equal.

- B. Heavy Intermediate Awning or Fixed Steel Windows: Heavy custom windows shall be manufactured from solid hot rolled steel shapes.
  - 1. Combined weight of frame and ventilator sections shall be a minimum of 4.20 pounds per lineal foot. Frame section alone shall not weigh less than 1.80 pounds per lineal foot.
- C. Operating Types: Provide the following window types in locations indicated on Drawings:
  - 1. Projected: Awning (in swing).
  - 2. Fixed.
- D. Operable Hardware:
  - 1. Awning, Hopper:
    - a. Fastener: Brass or Bronze cam fastener.
    - b. Ventilators shall be hung on heavy-duty stainless steel four bar hinges with brass friction shoes.
- E. Fasteners: Stainless steel screws for hardware, trim, covers, anchoring, weather bars, water dams, screens, etc. Glazing bead retainer screws are plated steel.

## 2.4 FABRICATION

- A. Fabricate hot-rolled steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
- B. Provide units that are reglazable without dismantling framing.
- C. Prepare windows for site glazing.
- D. Subframes and Operable Sash: Formed of hot-rolled steel of profile indicated. Miter or cope corners, and weld and dress joints smooth.
- E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- F. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.
- G. Provide water-shed members above casement sash.
- H. Glazing:
  - 1. All windows shall be designed for outside glazing.
  - 2. Provide replaceable continuous glazing beads to suit the glass as specified.

## 2.5 GLAZING

- A. Glass and Glazing System: See Section 08 80 00 "Glazing" for glass units and glazing requirements for hot-rolled steel windows.

## 2.6 INSECT SCREENS

- A. Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, fully integrated with window. Locate screens on outside of window and provide for each operable exterior sash. Comply with SMA 1201.
- B. Aluminum Screen Frames: Manufacturer's standard extruded-aluminum or formed-tubular-aluminum members; with mitered, coped joints, or corner extrusions; concealed fasteners; adjustable rollers; and removable PVC or PE spline/anchor concealing edge of mesh.
  - 1. Frame Wall Thickness: 0.04 inch (1.0 mm) minimum.
  - 2. Finish:
    - a. Anodized aluminum in manufacturer's standard color.
- C. Glass-Fiber Mesh Fabric: Complies with ASTM D3656/D3656M; 20-by-20 or 20-by-30 count per sq. in. (645 sq. mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.
  - 1. Mesh Color: Gray.

## 2.7 ACCESSORIES

- A. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A123/A123M. Provide units with sufficient strength to withstand design pressure indicated.
- B. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

## 2.8 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling".
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough-opening dimensions, levelness of sill plate, and clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF HOT-ROLLED STEEL WINDOWS

- A. SWI Publication: Comply with applicable requirements in SWI's "Guidelines on How to Install Steel Windows," except where more stringent requirements are indicated.
- B. Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.
- C. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- D. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- E. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.
- F. Separate corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E2112.

### 3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts as recommended in writing by manufacturer.
- B. Clean factory-finished steel surfaces immediately after installing windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Avoid damaging protective coatings and finishes.

- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.
- D. Refinish or replace windows with damaged finish.

END OF SECTION 08 51 23.13

## SECTION 08 71 00 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
- C. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
  - 2. Division 08 Section "Flush Wood Doors".
  - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. 2010 ADA Standards for Accessible Design.
  - 2. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 3. CBC - California Building Code, City of Lancaster Amendments.
  - 4. NFPA 70 - National Electrical Code.
  - 5. NFPA 80 - Fire Doors and Windows.
  - 6. NFPA 101 - Life Safety Code.
  - 7. NFPA 105 - Installation of Smoke Door Assemblies.
  - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series.
  - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
  - 3. ANSI/UL 294 - Access Control System Units.
  - 4. UL 305 - Panic Hardware.
  - 5. ANSI/UL 437- Key Locks.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the City has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. City must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Proof of Compliance: (California located Projects): Provide a list of product(s) containing chemicals known to cause cancer or reproductive toxicity as defined by the Office of Environmental Health Hazard Assessment (OEHHA) under Proposition 65 (CA Code of Regulations, Title 27, Section 27001). The list includes the specific

chemical(s), if the chemical will be exposed to consumers, the means of warning, and an illustration of the label.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and City concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 3. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  - 4. Review sequence of operation narratives for each unique access controlled opening.
  - 5. Review and finalize construction schedule and verify availability of materials.
  - 6. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.



- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to City via registered mail or overnight package service. Instructions for delivery to the City shall be established at the "Keying Conference".

## 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

## 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive City of other rights City may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the City. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, City, and their designated consultants.

## 2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
  - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
  - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

## 2.3 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
  1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  3. Manufacturers:
    - a. Rockwood (RO).

## 2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
  1. Manufacturers:
    - a. Sargent Manufacturing (SA).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
  1. Threaded mortise cylinders with rings and cams to suit hardware application.
  2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
  4. Tubular deadlocks and other auxiliary locks.
  5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  6. Keyway: Manufacturer's Standard.

- C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.
- D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with City having the ability for on-site original key cutting.
  - 1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
  - 2. Manufacturers:
    - a. Sargent (SA) - Degree DG1.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
  - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by City.
  - 3. Existing System: Field verify and key cylinders to match City's existing system.
- F. Key Quantity: Provide the following minimum number of keys:
  - 1. Change Keys per Cylinder: Two (2)
  - 2. Master Keys (per Master Key Level/Group): Five (5).
  - 3. Construction Keys (where required): Ten (10).
  - 4. Construction Control Keys (where required): Two (2).
  - 5. Permanent Control Keys (where required): Two (2).
- G. Construction Keying: Provide temporary keyed construction cores.
- H. Key Registration List (Bitting List):
  - 1. Provide keying transcript list to City's representative in the proper format for importing into key control software.
  - 2. Provide transcript list in writing or electronic file as directed by the City.

## 2.5 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
  - 1. Manufacturers:

- a. Sargent Manufacturing (SA) - 8200 Series.

## 2.6 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

- 1. Manufacturers:

- a. Sargent Manufacturing (SA) - 10X Line.

## 2.7 DEADLOCKS AND LATCHES

- A. Cylindrical Deadlocks: ANSI/BHMA A156.36 Grade 1 Certified Products Directory (CPD) listed deadlocks to fit standard ANSI 161 preparation. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

- 1. Manufacturers:

- a. Sargent Manufacturing (SA) - 480 Series.

## 2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

- 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
- 2. Strikes for Bored Locks and Latches: BHMA A156.2.
- 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
- 4. Dustproof Strikes: BHMA A156.16.

## 2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
  2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  6. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
  7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  9. Rim Exit Devices: Exit device rails shall release with less than 5 pounds of pressure per the California Building Code.
  10. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  11. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  12. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 80 Series.



## 2.10 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
  4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
  2. Manufacturers:
    - a. Sargent Manufacturing (SA) - 351 Series.

## 2.11 ARCHITECTURAL TRIM

- A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
  - a. Rockwood (RO).

## 2.12 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Rockwood (RO).

## 2.13 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
- C. isdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

- D. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- E. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- F. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- G. Manufacturers:
  - 1. Pemko (PE).

## 2.14 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.15 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of City occupancy.

### 3.7 DEMONSTRATION

- A. Instruct City's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the City and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
  - 1. Quantities listed are for each pair of doors, or for each single door.
  - 2. The supplier is responsible for handing and sizing all products.
  - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

**Hardware Sets**

**Set: 1.0**

Doors: 07

3 Hinge (heavy weight)	T4A3386 (NRP)	US32D	MK
1 Rim Exit Device, Storeroom	43 5CH 64 8804 ETL	US32D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer - Closer Stop	CPS7500	689	NO
1 Gasketing	303AS		PE
1 Rain Guard	346C (Omit @ overhang)		PE
1 Sweep	315CN		PE
1 Threshold	171A or Per Sill Detail		PE

**Set: 2.0**

Doors: 03A, 03C

3 Hinge (heavy weight)	T4A3386 (NRP)	US32D	MK
1 Rim Exit Device, Classroom	43 5CH 64 8813 ETL	US32D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer - Closer Stop	CPS7500	689	NO
1 Gasketing	303AS		PE
1 Rain Guard	346C (Omit @ overhang)		PE
1 Sweep	315CN		PE
1 Threshold	171A or Per Sill Detail		PE

**Set: 3.0**

Doors: 06B, 09B

3 Hinge, Full Mortise	TA2314 (NRP)	US32D	MK
1 Deadbolt	64 486	US26D	SA
1 Core	DG1 6300	US15	SA
1 Push Pull Plate	110x73C/73CL	US32D	RO



SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

1 Surface Closer - Closer Stop	CPS7500	689	NO
1 Mop Plate	K1050 6" high CSK BEV	US32D	RO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	303AS		PE
1 Rain Guard	346C (Omit @ overhang)		PE
1 Sweep	315CN		PE
1 Threshold	171A or Per Sill Detail		PE

**Set: 4.0**

Doors: 06A, 09A

3 Hinge, Full Mortise	TA2314 (NRP)	US32D	MK
1 Deadbolt	64 486	US26D	SA
1 Core	DG1 6300	US15	SA
1 Push Pull Plate	110x73C/73CL	US32D	RO
1 Surface Closer - Tri-pack	7500 mounting as req'd	689	NO
1 Mop Plate	K1050 6" high CSK BEV	US32D	RO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Door Stop & Holder	491 Series	US26D	RO
1 Gasketing	303AS		PE
1 Rain Guard	346C (Omit @ overhang)		PE
1 Sweep	315CN		PE
1 Threshold	171A or Per Sill Detail		PE

Notes: Template hinges and holder for 180 degrees.

**Set: 5.0**

Doors: 08, 10

3 Hinge, Full Mortise	TA2314 (NRP)	US32D	MK
1 Storeroom/Closet Lock	64 10XG04 LL	US26D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer - Closer Stop	CPS7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	303AS		PE
1 Rain Guard	346C (Omit @ overhang)		PE
1 Sweep	315CN		PE
1 Threshold	171A or Per Sill Detail		PE

**Set: 6.0**

Doors: 01

3 Hinge, Full Mortise	TA2314 (NRP)	US32D	MK
1 Entry/Office Lock	64 10XG05 LL	US26D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer - Closer Stop	CPS7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	303AS		PE
1 Rain Guard	346C (Omit @ overhang)		PE
1 Sweep	315CN		PE
1 Threshold	171A or Per Sill Detail		PE

**Set: 7.0**

Doors: 02, 05

3 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Storeroom/Closet Lock	64 10XG04 LL	US26D	SA
1 Wall Stop	403	US26D	RO
3 Silencer	608-RKW		RO

**Set: 8.0**

Doors: 03B

3 Hinge, Full Mortise	TA2714 (NRP)	US26D	MK
1 Entry/Office Lock	64 10XG05 LL	US26D	SA
1 Wall Stop	403	US26D	RO
3 Silencer	608-RKW		RO

END OF SECTION 08 71 00

## SECTION 08 80 00 - GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Glass for windows, doors, interior borrowed lites, storefront framing, and entrance doors.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for mirrors.

#### 1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

#### 1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
1. Insulating glass.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths.

- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturers of insulating-glass units.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
  - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. ed and certified by coated-glass manufacturer.
- C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

## 1.7 WARRANTY

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- B. urfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Vitro Architectural Glass (formally PPG Glass) (Basis of Design).
  - 2. Guardian Industries.
  - 3. OldCastle Building Envelope (KPS Capital Partners). [www.obe.com](http://www.obe.com)
  - 4. Pilkington North America.
  - 5. Viracon, Inc.
  - 6. Or equal.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
  - 1. Obtain tinted glass from single source from single manufacturer.
  - 2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E 1300.
  - 1. Design Wind Pressures: As indicated on Drawings.
  - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
    - a. Wind Design Data: As indicated on Drawings.
  - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
  - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties as indicated on Drawings
- F. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: "Glazing Manual."
  - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. .
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.



E. tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

F. Coated Low-Emissivity (Low-E) Glass: ASTM C 1036, Condition C (other coated glass) Type I, Class 1 (clear), Quality-Q3 with coating type and performance characteristics that comply with performance requirements.

G. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

H. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.

## 2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

## 2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C.     ance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable

stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
  - 2. t cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.7 MONOLITHIC GLASS SCHEDULE

- A. Glass Type: Clear tempered glass at interior locations, unless indicated otherwise on drawings.
  - 1. Minimum Thickness: 1/4-inch (6 mm).

### 3.8 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Clear Insulating Glass Type TLG:

1. Basis-of-Design Product: Vitro Architectural Glass; Solarcool (2) Azuria + Solarban 70 (3).
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Interspace Content: Air.
5. Low-E Coating: Winter Nighttime U-Factor: 0.28 maximum.
6. Visible Light Transmittance: 19 percent minimum.
7. SGHC: 0.16 maximum.
8. Outdoor Appearance: Clear.

B. Ceramic-Coated, Low-E, Insulating Spandrel Glass Type TLSP:

1. Basis-of-Design Product: Spandrel Glass Insulating Unit to Match glass type TLG.
2. Low-E Coating Color: Match vision glass type TLG.
3. Overall Unit Thickness: 1 inch (25 mm).
4. Minimum Thickness of Each Glass Lite: 6 mm.
5. Outdoor Lite: Match vision glass type TLG.
6. Interspace Content: Air.
7. Indoor Lite: Match vision glass type TLG.
8. Low-E Coating: Sputtered on second surface.
9. Opaque Coating Location: Fourth surface.

C. Silicone-Coated, Low-E, Insulating Spandrel Glass Type TLSP:

1. Basis-of-Design Product: Spandrel Glass Insulating Unit to Match glass type TLG.
2. Low-E Coating Color: Match vision glass type TLG.
3. Overall Unit Thickness: 1 inch (25 mm).
4. Minimum Thickness of Each Glass Lite: 6 mm.
5. Outdoor Lite: Match vision glass type TLG.
6. Interspace Content: Air.
7. Indoor Lite: Match vision glass type TLG.
8. Low-E Coating: Sputtered on second surface.
9. Opaque Coating Location: Fourth surface.

END OF SECTION 08 80 00

## SECTION 08 91 19 - FIXED LOUVERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum louvers.

B. Related Requirements:

1. Section 08 11 13 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
2. Section 08 14 16 "Flush Wood Doors" for louvers in flush wood doors.

#### 1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing in accordance with AMCA 540.

#### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Sample Warranties: For manufacturer's special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

#### 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

#### 1.7 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.



2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.
  1. Wind Loads:
    - a. Determine loads based on a uniform pressure of 25 lbf/sq. ft. (1197 Pa), acting inward or outward.
- B. Seismic Performance:
  1. As indicated on Drawings.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

### 2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Drainable-Blade Louver, Extruded Aluminum:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Industrial Louvers Inc.

- b. Reliable Products, Inc.
  - c. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
  - d. Or equal.
- 2. Louver Depth: 6 inches (150 mm).
- 3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
- 4. Louver Performance Ratings:
  - a. Free Area: Not less than 8.5 sq. ft. (0.79 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
  - b. Point of Beginning Water Penetration: Not less than 1100 fpm (5.6 m/s).
  - c. Air Performance:
    - 1) Not more than 0.15-inch wg (37-Pa) static pressure drop at 900-fpm (4.6-m/s) free-area intake velocity.
- 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Insect screening.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
- D. Louver Screening for Aluminum Louvers:
  - 1. Insect Screening, Aluminum: 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

## 2.5 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Use types and sizes to suit unit installation conditions.
  - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
  - 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
  - 3. For color-finished louvers, use fasteners with heads that match color of louvers.

## 2.6 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat.
  - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

## SECTION 09 24 00 - CEMENT PLASTERING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Metal lath.
2. Base-coat cement plaster.
3. Cement plaster finish coats.
4. Accessories.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Metal lath.
2. Base-coat cement plaster.
3. Cement plaster finish coats.
4. Accessories.

### PART 2 - PRODUCTS

#### 2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.

1. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).
2. Flat-Rib Lath: Rib depth of not more than 1/8 inch (3 mm), 3.4 lb/sq. yd. (1.8 kg/sq. m).

B. Wire-Fabric Lath:

1. Welded-Wire Lath: ASTM C933; self-furring, 1.4 lb/sq. yd. (0.8 kg/sq. m).
2. Woven-Wire Lath: ASTM C1032; self-furring, with stiffener wire backing, 1.4 lb/sq. yd. (0.8 kg/sq. m).

C. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.

## 2.2 BASE-COAT CEMENT PLASTER

- A. General: Comply with ASTM C926 for applications indicated.
  - 1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
  - 1. Portland Cement Mixes:
    - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
    - b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
  - 2. Masonry Cement Mixes:
    - a. Scratch Coat: Mix 1 part masonry cement and 2-1/2 to 4 parts aggregate.
    - b. Brown Coat: Mix 1 part masonry cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
  - 3. Portland and Masonry Cement Mixes:
    - a. Scratch Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
    - b. Brown Coat: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
  - 4. Plastic Cement Mixes:
    - a. Scratch Coat: Mix 1 part plastic cement and 2-1/2 to 4 parts aggregate.
    - b. Brown Coat: Mix 1 part plastic cement and 3 to 5 parts aggregate, but not less than volume of aggregate used in scratch coat.
  - 5. Portland and Plastic Cement Mixes:
    - a. Scratch Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.

- b. Brown Coat: For cementitious material, mix 1 part plastic cement and 1 part portland cement. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
- C. Base-Coat Mixes for Use over Low-Absorption Unit Masonry and Concrete: Single base (scratch) coat for two-coat plasterwork on low-absorption plaster bases as follows:
  - 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
  - 2. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
  - 3. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.
- D. Base-Coat Mixes for Use over High-Absorption Unit Masonry and Concrete: Single base (scratch) coat for two-coat plasterwork on high-absorption plaster bases as follows:
  - 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
  - 2. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
  - 3. Portland and Masonry Cement Mix: For cementitious material, mix 1 part portland cement and 1 part masonry cement. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
  - 4. Plastic Cement Mix: Use 1 part plastic cement and 2-1/2 to 4 parts aggregate.

## 2.3 CEMENT PLASTER FINISH COATS

- A. Job-Mixed Finish-Coat Mixes:
  - 1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
  - 2. Masonry Cement Mix: Use 1 part masonry cement and 1-1/2 to 3 parts aggregate.
  - 3. Portland and Masonry Cement Mix: For cementitious materials, mix 1 part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
  - 4. Plastic Cement Mix: Use 1 part plastic cement and 1-1/2 to 3 parts aggregate.
- B. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.



1. Color: As selected by Architect from manufacturer's full range.

- C. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

1. Color: As selected by Architect from manufacturer's full range.

## 2.4 ACCESSORIES

- A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

- B. Metal Accessories:

1. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A653/A653M, G60 (Z180) zinc coating.
2. Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
3. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60 (Z180), hot-dip galvanized-zinc coating.
4. Cornerbeads: Fabricated from zinc-coated (galvanized) steel or anodized aluminum.
  - a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
  - b. Smallnose cornerbead with perforated flanges; use on curved corners.
  - c. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
  - d. Bullnose cornerbead, radius 3/4 inch (19 mm) minimum, with expanded flanges; use at locations indicated on Drawings.
5. Casing Beads: Fabricated from zinc-coated (galvanized) steel or anodized aluminum; square-edged style; with expanded flanges.
6. Control Joints: Fabricated from zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
7. Expansion Joints: Fabricated from zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
8. Two-Piece Expansion Joints: Fabricated from zinc-coated (galvanized) steel or anodized aluminum; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6 to 16 mm) wide; with perforated flanges.
9. Reveals: Aluminum channel screed, vented, 6063-T5 alloy, Fry Reglet Corp.; PCS-75-V-50, or equal.
  - a. Finish: Clear anodized, unless indicated otherwise on Drawings.

## 2.5 PLASTER MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type II.
  - 1. Color for Finish Coats: White.
- B. Masonry Cement: ASTM C91/C91M, Type N.
  - 1. Color for Finish Coats: White.
- C. Plastic Cement: ASTM C1328/C1328M.
- D. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match Architect's sample.
- E. Lime: ASTM C206, Type S; or ASTM C207, Type S.
- F. Sand Aggregate: ASTM C897.
  - 1. Color for Job-Mixed Finish Coats: White.

## 2.6 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.
- C. Bonding Compound: ASTM C932.
- D. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.
- E. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter unless otherwise indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster in accordance with ASTM C926.

### 3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.
- B. Sound-Attenuation Blankets: Where required, install blankets before installing lath unless blankets are readily installed after lath has been installed on one side.

### 3.4 INSTALLATION OF METAL LATH

- A. Metal Lath: Install in accordance with ASTM C1063.
  - 1. Partition Framing and Vertical Furring: Install self-furring diamond-mesh lath.
  - 2. Flat-Ceiling and Horizontal Framing: Install flat-rib lath.
  - 3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

### 3.5 INSTALLATION OF ACCESSORIES

- A. Install in accordance with ASTM C1063 and at locations indicated on Drawings.
- B. Reinforcement for External (Outside) Corners:
  - 1. Install cornerbead at exterior locations.
  - 2. Install cornerbead at interior locations.
- C. Control Joints: Locate as approved by Architect for visual effect and as follows:
  - 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
    - a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
    - b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
  - 2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
  - 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
  - 4. Where control joints occur in surface of construction directly behind plaster.

5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

### 3.6 APPLICATION OF BASE-COAT CEMENT PLASTER

- A. General: Comply with ASTM C926.
  1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
  2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
  3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Bonding Compound: Apply on unit masonry and concrete substrates for direct application of plaster.
- C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch (19-mm) total thickness, as follows:
  1. Portland cement mixes.
- D. Ceilings; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork and having 1/2-inch (13-mm) total thickness, as follows:
  1. Portland cement mixes.

### 3.7 APPLICATION OF CEMENT PLASTER FINISH COATS

- A. Plaster Finish Coats: Apply to provide fine sand finish to match Architect's sample.
- B. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.
- C. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.
- D. Concealed Interior Plasterwork:
  1. Where plaster application is concealed behind built-in cabinets, similar furnishings, and equipment, apply finish coat.
  2. Where plaster application is concealed above suspended ceilings and in similar locations, omit finish coat.

3. Where plaster application is used as a base for adhesive application of tile and similar finishes, omit finish coat.

### 3.8 REPAIR

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

### 3.9 CLEANING

- A. Remove temporary protection and enclosure of other work after plastering is complete.
- B. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered.
- C. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 24 00

## SECTION 092900 - GYPSUM BOARD

### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Tile backing panels.

### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. each area and that correspond with support system indicated.

### 2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
  - 1. Thickness: 5/8 inch .

2. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

## 2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Certainteed; Fiber Cement BackerBoard.
  - b. United States Gypsum Company; Durock Brand.
  - c. National Gypsum; PermaBase Brand.
  - d. Or equal.
2. Thickness: 1/2 inch (12.7 mm).
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

B. Coated Glass-Mat, Water-Resistant Gypsum Backing Panel: ASTM C1178/C1178M, with a water-resistant coating on one surface, and manufacturer's standard edges.

1. Core: As indicated on Drawings, regular type.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

## 2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:



- a. Cornerbead.
- b. Bullnose bead.
- c. LC-Bead: J-shaped; exposed long flange receives joint compound.
- d. L-Bead: L-shaped; exposed long flange receives joint compound.
- e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- f. Expansion (control) joint.
- g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

## 2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
  - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose, or sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

## 2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  1. Adhesives shall have a VOC content of 50 g/L or less.
  2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
  1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  2. recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
  1. Sealant shall have a VOC content of 250 g/L or less.
  2. It have a VOC content of 250 g/L or less.
  3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
  - 2. Type X: Where required for fire-resistance-rated assembly.
  - 3. Ceiling Type: Ceiling surfaces.
  - 4. Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners.

- E. Aluminum Trim: Install in locations indicated on Drawings.

### 3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: Panels that are to receive wall coverings.
  - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

## SECTION 09 30 13 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Glazed wall tile.
3. Thresholds.
4. Waterproof membranes.
5. Crack isolation membranes.
6. Setting material.
7. Grout materials.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of movement joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for tile backing panels.

#### 1.2 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches (381 mm) or longer.
- D. Module Size: Actual tile size plus joint width indicated.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Porcelain tile.
2. Thresholds.
3. Waterproof membranes.
4. Crack isolation membranes.
5. Setting material.
6. Grout materials.



- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces. Show thresholds.
- C. Samples: For tile, grout, and accessories involving color selection or shade variation.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in "Referenced Standards" Article in the Evaluations and manufacturer's written instructions.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard Grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  - 1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## 2.2 PORCELAIN TILE

- A. Porcelain Tile Type : Glazed.
  - 1. Tile Color, Glaze, and Pattern: As indicated on Drawings. If not indicated, then as selected by Architect from manufacturer's full range.
  - 2. Grout Color: As selected by Architect from manufacturer's full range.
  - 3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

## 2.3 GLAZED WALL TILE

- A. Glazed Wall Tile Type:
  - 1. Tile Color and Pattern: As indicated on Drawings. If not indicated, then as selected by Architect from manufacturer's full range.
  - 2. Grout Color: As selected by Architect from manufacturer's full range.

## 2.4 Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C503/C503M, with a minimum abrasion resistance of 10 in accordance with ASTM C1353/C1353M or ASTM C241/C241M and with honed finish.

1. Description:

- a. Uniform, fine- to medium-grained white stone with gray veining.
- b. Match Architect's sample.

2.5 WATERPROOF MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Waterproof Membrane, Sheet: Polyethylene sheet faced on one or both sides with polyester fabric.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products; RedGuard, or Redgard Speedcote.
    - b. Ardex; S 1-K, or 8+9 Rapid Set.
    - c. Mapei; Mapelastic AquaDefence.
    - d. Sika USA; SikaTile 100 Moisture Guard
    - e. Or equal.
  - 2. Nominal Thickness: 0.03 inch (0.8 mm).
- C. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with fabric reinforcement.

2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products; RedGuard, or Redgard Speedcote.
    - b. Ardex; S 1-K, or 8+9 Rapid Set.
    - c. Mapei; Mapelastic AquaDefence.
    - d. Sika USA; SikaTile 100 Moisture Guard
    - e. Or equal.
    - f. Nominal Thickness: 0.03 inch (0.8 mm).
- B. Crack Isolation Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with fabric reinforcement.

## 2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
  - 1. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A1064/A1064M except for minimum wire size.
  - 2. Latex Additive: Manufacturer's standard acrylic resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 2. Provide prepackaged, dry-mortar mix combined with styrene-butadiene-rubber liquid-latex additive at Project site.
  - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.
- C. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
  - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 2. Provide prepackaged, dry-mortar mix combined with styrene-butadiene-rubber liquid-latex additive at Project site.
  - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.

## 2.8 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Standard Cement Grout: ANSI A118.6.
- C. High-Performance Tile Grout: ANSI A118.7.
  - 1. Polymer Type:
    - a. Dry, redispersible form, prepackaged with other dry ingredients.
    - b. Liquid-latex form for addition to prepackaged dry-grout mix.

## 2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils (0.1 mm) thick.
- C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Blanke Corporation.
    - b. Schluter Systems L.P.
    - c. Or equal.
  - 2. Description: Provide shapes as indicated on Drawings.
  - 3. Material and Finish: Polished nickel anodized aluminum, or color-coated aluminum exposed-edge material.
- D. Metal Edge Trim: Profile designed for wall terminations and edge protection.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Blanke Corporation.
    - b. Schluter Systems L.P.
    - c. Or equal.
  - 2. Terminations: End caps, inside and outside corners, cove (base to floor transition) matching edge-protection profile.
  - 3. Material and Finish: Polished nickel anodized aluminum, or Color-coated aluminum exposed-edge material.
- E. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.
- F. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- G. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. indicated.
  - 3. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 4. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 5. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot (1:50) toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as

those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches (381 mm), confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. (6.4 mm in 3 m) from the required plane, and no more than 1/16 inch in 12 inches (1.5 mm in 300 mm) when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches (381 mm) or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. (3 mm in 3 m) from the required plane, and no more than 1/16 inch in 24 inches (1.5 mm in 609 mm) when measured from tile surface high points.

F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### 3.3 INSTALLATION OF CERAMIC TILE SYSTEM

- A. See Section 09 29 00 "Gypsum Board" for installation of tile backing panels and treating joints.
- B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.
- C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
1. Allow crack isolation membrane to cure before installing tile or setting materials over it.
- D. Mix mortars and grouts to comply with "Referenced Standards" Article in the Evaluations and mortar and grout manufacturers' written instructions.
1. Add materials, water, and additives in accurate proportions.
  2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.



- E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
- F. lation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Exterior tile floors and walls.
    - b. Tile floors in wet areas.
    - c. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    - d. Tile floors consisting of rib-backed tiles.
  - 2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
  - 3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
  - 4. , piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
  - 5. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
  - 6. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
  - 7. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
    - a. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    - b. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
  - 8. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

- H. prior to filling with sealants. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- J. Metal Flooring Transitions: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- K. Metal Wall Trim: Install at locations indicated on Drawings.
- L. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### 3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.6 EXTERIOR CERAMIC TILE INSTALLATION SCHEDULE

#### A. Exterior Wall Installations, Wood or Metal Studs:

1. TCNA W244E: Thinset mortar on cementitious backer units over water-resistive barrier.
  - a. Ceramic Tile Type: As indicated on Drawings.
  - b. Thinset Mortar: Modified dry-set, or Improved modified dry-set mortar.
  - c. Grout: High-performance unsanded cement grout.
  - d. Water-Resistive Barrier: Compliant with local code requirements .
  - e. Joint Width: 1/8 inch (3.2 mm), unless indicated otherwise on Drawings .
  - f. Movement Joints: Types located on Drawings.

### 3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

#### A. Interior Floor Installations, Concrete Subfloor:

1. TCNA F121: Method ANSI A108.1B. Cement mortar bed (thickset) installed over cleavage membrane, with waterproofing/crack isolation membrane
  - a. Ceramic Tile Type: Porcelain.
  - b. Grout: High-performance unsanded cement grout.
  - c. Waterproofing/Crack Isolation Membrane: Fabric-reinforced, fluid-applied membrane.
  - d. Joint Width: 1/8 inch (3.2 mm), unless indicated otherwise on Drawings.
  - e. Movement Joints: Types located on Drawings.

#### B. Interior Wall Installations, Masonry or Concrete:

1. TCNA W202I: Thinset mortar over waterproof membrane.
  - a. Ceramic Tile Type: Porcelain.
  - b. Thinset Mortar: Modified dry-set, or Improved modified dry-set mortar.
  - c. Grout: High-performance unsanded cement grout.
  - d. Waterproof Membrane: .
  - e. Joint Width: 1/8 inch (3.2 mm), unless indicated otherwise on Drawings.
  - f. Movement Joints: Types located on Drawings.
2. TCNA W245: Thinset mortar on glass-mat, water-resistant gypsum backer board over waterproof membrane.
  - a. Ceramic Tile Type: Porcelain.
  - b. Thinset Mortar: Modified dry-set, or Improved modified dry-set mortar.
  - c. Grout: High-performance unsanded cement grout.
  - d. Waterproof Membrane: Fabric-reinforced, fluid-applied membrane.
  - e. Joint Width: 1/8 inch (3.2 mm), unless indicated otherwise on Drawings.

- f. Movement Joints: Types located on Drawings.

END OF SECTION 09 30 13

## SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
- B. following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Ceiling suspension-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
    - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
  - 5. Size and location of initial access modules for acoustical panels.
  - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    - a. Lighting fixtures.
    - b. Diffusers.
    - c. Grilles.
    - d. Speakers.
    - e. Sprinklers.
    - f. Perimeter moldings.
  - 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.

- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.

### 2.3 ACOUSTICAL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corporation.
  - 3. Chicago Metallic Corporation.
  - 4. United States Gypsum Company.
  - 5. Or equal.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 36 percent.
- D. ASTM E1264 Classification: Provide panels as follows:

1. Type and Form: Type III, mineral fiber with factory-applied vinyl latex paint; Form 2, Pattern: C D.
- E. Color: White.
- F. Thickness: 5/8 inch (15 mm).
- G. Edge: Square.
- H. Modular Size: 24 by 24 inches (600 by 600 mm).
- I. Product: Armstrong; Cortega Miniboard 770.

## 2.4 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Armstrong World Industries, Inc.; Prelude XL 15/16" (Basis of Design).
  2. CertainTeed Corporation.
  3. Chicago Metallic Corporation.
  4. United States Gypsum Company.
  5. Or equal.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
  1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
  1. Structural Classification: Heavy-duty system.

## 2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Hold-Down Clips: Manufacturer's standard hold-down.



- C. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
  - 1. BERC2 by Armstrong
  - 2. other clips
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Anchors:
  - 1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
- G. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
  - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.
- H. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
- B. nners.

## 2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 07 92 00 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

### 3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.

4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Install hold-down and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

### 3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

### 3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

## SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient molding accessories.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

### PART 2 - PRODUCTS

#### 2.1 THERMOSET-RUBBER BASE

- A. A.Manufacturers: Subject to compliance with requirements
  - 1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
  - 2. Flexco.
  - 3. Johnsonite; a Tarkett company.
  - 4. Roppe Corporation, USA.
  - 5. Or equal.
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
  - 1. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Thickness: 0.125 inch (3.2 mm).
- D. Height: As indicated on Drawings.
- E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.

- H. Colors: As selected by Architect from manufacturer's standard color selections.

## 2.2 RUBBER MOLDING ACCESSORY

- A. A.Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Roppe Corporation, USA.
  - 2. VPI Corporation.
  - 3. Or equal.
- B. Description: Rubber carpet edge for glue-down applications nosing for carpet nosing for resilient floor covering reducer strip for resilient floor covering joiner for tile and carpet transition strips.
- C. Profile and Dimensions: As indicated.
- D. Colors and Patterns: Match City's sample.

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.



- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Miter or cope corners to minimize open joints.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.

- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

## SECTION 09 65 16 - RESILIENT SHEET FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Rubber sheet flooring.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Provide VOC Certification such as FloorScore or Green Guard GOLD and TDS/SDS
- C. Shop Drawings: For each type of resilient sheet flooring.
  - 1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 2. Show details of special patterns.
- D. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
  1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

#### 1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient sheet flooring during the following periods:
  1. 48 hours before installation.
  2. During installation.
  3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 2.2 UNBACKED RUBBER SHEET FLOORING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexco.
2. Johnsonite; a Tarkett company.
3. Mondo USA.
4. Nora Systems, Inc.
5. VPI Corporation
6. Or equal..

- B. Product Standard: ASTM F1859.

1. Type: Type I, homogeneous rubber sheet floor covering.
2. Thickness: As standard with manufacturer.
3. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D2240.

- C. Wearing Surface: Smooth.

- D. Sheet Width: As standard with manufacturer.

- E. Seamless-Installation Method: Chemically bonded.

- F. Colors and Patterns: Match Owner's samples.

### 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

- C. Seamless-Installation Accessories:

1. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Concrete Substrates: Prepare according to ASTM F710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
  - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
  - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.
  1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

### 3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
  1. Maintain uniformity of flooring direction.
  2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
  3. Match edges of flooring for color shading at seams.
  4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.



- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
  - 1. Chemically Bonded Seams: Bond seams with chemical-bonding compound to fuse sections permanently into a seamless flooring installation. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches (152 mm) up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
  - 1. Install metal corners at inside and outside corners.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
  - 1. Remove adhesive and other blemishes from surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.
  - 1. Apply two coat(s).
- E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 65 16

## SECTION 09 65 19 - RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Luxury Vinyl Tile (LVT).
2. Underlayment.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For chemical-bonding compounds, indicating VOC content.
4. Laboratory Test Reports: For chemical-bonding compounds, indicating compliance with requirements for low-emitting materials.
5. Product Data: For sealants, indicating VOC content.
6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
7. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.

#### 1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## 1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer warrants floor tile products to be free from manufacturing defects for 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

### 2.2 LUXURY VINYL TILE (LVT) FL-#

- A. Luxury vinyl tile with underlay: ASTM F 1700; Class III, Type B - Embossed.
- B. Manufacturers: Subject to compliance with requirements, provide listed products by the following only:
  - 1. Shaw Industries Group, Inc.
  - 2. No substitutions.
- C. Collection: Grain + Pigment.
- D. Style Number: 0367V.
- E. Color: Chicory 64752.
- F. Thickness: 0.157inch (4 mm) (Overall). Wear surface: 20 mils, 0.02-inch (0.5 mm).
- G. Size: 7 by 48-inch (180 by 1200 mm).
- H. Edge: Micro Bevel.
- I. Finish: UV cured polyurethane.
- J. Installation Method: Floating.

### 2.3 LUXURY VINYL TILE (LVT) FL-#

- A. Luxury vinyl tile with underlay: ASTM F 1700; Class III, Type B - Embossed.
- B. Manufacturers: Subject to compliance with requirements, provide listed products by the following only:

1. Armstrong.
2. Forbo.
3. Mannington.
4. Mohawk Group.
5. Shaw Industries Group, Inc.
6. Or equal.

- C. Thickness: 0.20 (5 mm) (Overall). Wear surface: 20 mils, 0.02-inch (0.5 mm).
- D. Size: 24 by 24-inch.
- E. Finish: UV cured polyurethane.
- F. Colors and Patterns: As selected by Architect from manufacturers standard selections.
- G. Installation Method: Staggered, unless indicated otherwise on Drawings.

## 2.4 UNDERLAYMENT

- A. Underlayment – Foam Type: S-1840 Quiet Comfort by Armstrong or Silencer LVT by Foam Products; [www.foamproducts.com](http://www.foamproducts.com).
1. Thickness: 0.075-inch.
  2. Width: 48-inches.
  3. Coverage: 100 sq. ft. per roll.
- B. Underlayment – Panel Type: Minimum 1/4-inch thickness; Artic (Baltic) Birch, A/C grade plywood with sanded face, or other underlayment grade exterior plywood.
1. Do not use Luan Plywood, OSB, particleboard, CDX, pressure treated plywood, oil-treated or other coated plywood, Masonite or other hardboard.

## 2.5 ACCESSORY MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
1. Adhesives shall have a VOC content of 100 g/L or less.
  2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

3. Sealant shall have a VOC content of 150 g/L or less.
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

- b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install LVT tiles until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.3 UNDERLAYMENT INSTALLATION

- A. Foam type underlayment: Begin installing underlayment in a corner and install parallel to the wall in the opposite direction you plan to install the flooring planks. Leave at least 2-inches of excess underlayment up the wall and trim after completing the floor installation.
  - 1. Roll out the next roll of underlayment one inch wide packing tape can be used to attach the seams. Tape seams together with 2-inch wide tape that meets the moisture vapor transmission rate for this type of installation.
  - 2. Provide foam underlayment over concrete and panel underlayment prior to installing LVT.
- B. Panel type underlayment: Panels shall be installed according to manufacturer's instructions regarding fastener pattern, sanding and filling of joints, and acclimation to installed environment. Stagger joints of underlayment so that no joints occur over joints in subfloor. Fill depressions and sand smooth.
  - 1. Recess fastener head 1/16-inch below the surface and penetrate 75% to 90% of the sub floor assembly but not to protrude through the bottom of subfloor sheathing.
  - 2. Patch over top of fastener with trowelable leveling and patching compound.

### 3.4 LUXURY VINYL TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floating LVT floor system over foam type underlayment. Foam type underlayment is not adhered to substrate.



- B. Make sure the subfloor is clean, flat, dry and sound. It is important that the subfloor is free of all debris. Check the subfloor for unevenness or protruding objects such as nails or screws.
- C. When installing over concrete, the concrete must be dry with moisture vapor emission rate not exceeding 7 lbs. per 1000 square feet per 24 hours as measured by the Calcium Chloride Test and 93% RH using In-situ Probe.
- D. Begin in a corner and install the underlayment parallel to the wall in the opposite direction you plan to install the flooring planks. Leave at least 2 inches of excess underlayment up the wall and trim after completing the floor installation.
- E. Roll out the next roll of underlayment in the same manner, making sure that the foam seams are butted together. Tape seams together using 2 inch wide clear packing tape.
- F. Follow manufacturer's instructions for interlocking edges of LVT.
- G. Roll flooring after installation in accordance with manufacturer's written instructions.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 19

## SECTION 09 67 23 - RESINOUS FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Resinous flooring.

B. Related Sections:

1. Section 07 18 00 "Traffic Coatings" for vehicular-traffic-bearing, elastomeric flooring systems.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples: For each resinous flooring system required and for each color and texture specified, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

#### 1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resinous flooring to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Flammability: Self-extinguishing in accordance with ASTM D635.

### 2.2 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Master Builders Solutions (Sika); Mastertop 1234 System.
    - b. Crossfield Products Corp.; Dex-o-Tex Colorflake.
    - c. Sherwin-Williams High Performance Flooring; Resufloor UVE.
    - d. Sika Corporation; Sikafloor DecoDur Flake.
    - e. Stonhard, Inc.; Stontec.
    - f. Or equal.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
- C. System Characteristics:
1. Color and Pattern: As selected by Architect from manufacturer's full range.
  2. Wearing Surface: Textured for slip resistance.
  3. Overall System Thickness: 1/8 inch (3.2 mm).
- D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:
1. Compressive Strength: 10,000 minimum in accordance with ASTM C579.
  2. Tensile Strength: 5,000 psi minimum in accordance with ASTM D638.
  3. Impact Resistance: Exceeds 160 in.-lbs. per ASTM D4060, CS-17.
  4. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) in accordance with MIL-D-3134J.
  5. Abrasion Resistance: 0.04 gram maximum weight loss in accordance with ASTM D4060, CS-17.
  6. Hardness: 85-90, Shore D in accordance with ASTM D2240.
  7. Critical Radiant Flux: 0.45 W/sq. cm or greater in accordance with NFPA 253.

- E. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested in accordance with ASTM D1308 for 50 percent immersion in the following reagents for no fewer than seven days:

Reagent	Reagent
Acetic Acid 20%	Benzene
Acetone	Benzoic Acid
Hydrofluoric Acid	Butyl Alcohol
Lactic Acid 50%	Citric Acid
Nitric Acid 10%	Diesel Fuel
Phenol	Stearic Acid
Sulfuric Acid 45%	Amyl Acetate
Toluene	Dichloroacetic Acid
Trichloroethylene	Chlorobenzene

- F. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- G. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.
- H. Body Coats:
1. Resin: two-component epoxy.
  2. Type: Pigmented.
  3. Installation Method: Self-leveling slurry with broadcast aggregates.
  4. Number of Coats: Two.
  5. Thickness of Coats: 1/8 inch (3.2 mm).
  6. Aggregates: Colored quartz (ceramic-coated silica) .
- I. Topcoats: Sealing or finish coats.
1. Resin: Aliphatic polyurethane.
  2. Type: Clear Insert description.
  3. Number of Coats: Two.
  4. Thickness of Coats: 4mils (0.1 mm).
  5. Finish: Gloss.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Roughen concrete substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
  - 2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
  - 3. Moisture Testing: Perform tests so that each test area is evenly spaced in installation areas.
    - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
  - 4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate

alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,

- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.
  - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

### 3.3 INSTALLATION

- A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
  - 1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - 2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
- B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.
- C. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.
  - 1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.
- D. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

### 3.4 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

## SECTION 09 91 13 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
- B. Related Requirements:
  - 1. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates.
  - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
  - 3. Section 09 96 00 "High-Performance Coatings" for tile-like coatings.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Indicate VOC content.
- B. Sustainable Design Submittals:
  - 1. Emissions testing results indicating paint products VOC being in compliance with VOC limits of South Coast Air Quality Management District Rule 1113 "Architectural Coatings."
    - a. Flat Coatings: 50 g/L.
    - b. Nonflat Coatings: 50 g/L.
    - c. Waterproofing Concrete/Masonry Sealers: 100 g/L.
    - d. Primers, Sealers and Undercoaters: 100 g/L.
    - e. Rust Preventative Coatings: 100 g/L.
    - f. Industrial Maintenance Coatings: 100 g/L.
    - g. Stains, Interior: 250 g/L.
    - h. Wood coatings: 275 g/L.
- C. Samples: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.



- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### 1.3 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carboline.
  - 2. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
  - 3. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
  - 4. Sherwin-Williams Company (The).
  - 5. Vista Paint Corporation.
  - 6. Tnemec.
  - 7. Or equal.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior Painting Schedule for the paint category indicated.

### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

## 2.3 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Fiber-Cement Board: 12 percent.
  - 3. Masonry (Clay and CMUs): 12 percent.
  - 4. Wood: 15 percent.
  - 5. Portland Cement Plaster: 12 percent.
  - 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

## 2.4 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Existing Cement Plaster Substrates: Remove paint, dirt, loose plaster dust, or other contaminants. Patch and repair damaged plaster surfaces, fill cracks and holes with sealant. Sand rough surfaces to provide a uniform surface for painting.
- G. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 7/NACE No. 4.
  - 4. SSPC-SP 11.
- H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- J. Aluminum Substrates: Remove loose surface oxidation.
- K. Wood Substrates:
  - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- L. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

## 2.5 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations.

1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Paint entire exposed surface of window frames and sashes.
  5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Tanks that do not have factory-applied final finishes.

## 2.6 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: City may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
  2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

## 2.7 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 2.8 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
  - 1. Latex System:
    - a. Prime Coat: Primer, alkali resistant, water based.
      - 1) Dunn-Edwards, Eff-Stop Premium Primer ESPR00.
      - 2) S-W Loxon Concrete Masonry Primer, LX2W50.
      - 3) Vista 4600 Uniprime II.
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, flat.
      - 1) Dunn-Edwards, Spartashield SSSL10 Flat.
      - 2) S-W A-100 Acrylic Flat, A6.
      - 3) Vista 2800 Acriglo Acrylic Flat
    - d. Topcoat: Latex, exterior, low sheen.
      - 1) Dunn-Edwards, Spartashield SSSL40 Low Sheen.
      - 2) A-100 Acrylic Low Sheen, A12.
      - 3) Vista 1750 Acriglo Acrylic Low Sheen
    - e. Topcoat: Latex, exterior, semi-gloss.

- 1) Dunn-Edwards, Spartashield SSSL50 Semi-Gloss.
    - 2) S-W A-100 Satin, A82.
    - 3) Vista 7000 Acriglo Acrylic Semigloss
  2. Medium to High-Build Latex System: Dry film thickness of 8-10 mils DFT (medium-build), or 12-15 mils DFT (high-build).
    - a. Prime Coat: As recommended in writing by topcoat manufacturer.
    - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
    - c. Topcoat: Latex, exterior, medium to high build.
      - 1) Dunn-Edwards EDLX10 Enduralastic 10 Elastomeric.
      - 2) S-W Conflex Conflex XL Smooth CF16 Series (high-build).
      - 3) Vista 1900 Weather Master (medium-build), or Vista 500 Solotex (high-build).
  3. Clear Water-Based Sealer System:
    - a. 1st Coat: Matching topcoat.
    - b. Topcoat: Clear Sealer, water based.
      - 1) H&C Clarishield Natural Look Clear Concrete Sealer, or UltraPaver Natural Sealer (Sherwin-Williams).
      - 2) Monopole, Inc.; Monochem Permaseal, ME12, or Elastoseal (Silicone Elastomer).
      - 3) PPG; Dulux Perma-Crete Plex-Seal Acrylic Clear Sealer Exterior 4-6200XIC.
      - 4) Seal-Krete Clear Seal Protective Concrete Sealer, Satin by Rust-Oleum.
      - 5) Or equal.
- B. Concrete Substrates, Traffic Surfaces:
  1. Latex Floor Paint System:
    - a. Prime Coat: Floor paint, latex, matching topcoat.
    - b. Intermediate Coat: Floor paint, latex, matching topcoat; 1.5-2.0 DFT.
    - c. Topcoat: Floor paint, latex, low gloss; 1.5-2.0 DFT.
      - 1) PPG; Sico 261 series.

- 2) Vista; Arcripoxy II 400.
    - 3) Or equal.
  - d. Topcoat: Floor paint, latex, semigloss.
    - 1) S-W; Armorseal Tread-Plex B90 series.
    - 2) Or equal.
- 2. Water-based Polyurethane Acrylic Floor Paint System:
  - a. Prime Coat: Self-priming.
  - b. Intermediate Coat: Matching topcoat; 1.5-2.0 DFT.
  - c. Topcoat: WB Polyurethane Acrylic Floor Paint, low gloss; 1.5-2.0 DFT.
    - 1) PPG; Dulux WB Floor Enamel 247010.
    - 2) Or equal.
  - d. Topcoat: WB Polyurethane Acrylic Floor Paint, semigloss; 1.5-2.0 DFT.
    - 1) S-W; Armorseal 1K, WB Urethane Floor Enamel; B65W775.
    - 2) Or equal.
- 3. Clear Water-Based Sealer System, Satin (low gloss):
  - a. 1st Coat: Matching topcoat.
  - b. Topcoat: Sealer, water based, for concrete floors.
    - 1) H&C Clarishield Natural Look Clear Concrete Sealer.
    - 2) Monopole, Inc.; Monochem Aqualseal W20.
    - 3) PPG; Dulux Perma-Crete Plex-Seal Acrylic Clear Sealer Exterior 4-6200XIC.
    - 4) Rustoleum; Seal-Krete Clear Seal Protective Concrete Sealer, Satin.
    - 5) Or equal.
- C. Cement Board Substrates:
  - 1. Latex System:
    - a. Prime Coat: Primer, alkali resistant, water based.
      - 1) Dunn-Edwards, Eff-Stop Premium Primer ESPR00.



- 2) S-W Loxon Concrete Masonry Primer, LX2W50.
- 3) Vista 4600 Uniprime II
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, flat.
  - 1) Dunn-Edwards, Spartashield SSHL10 Flat.
  - 2) S-W A-100 Acrylic Flat, A6.
  - 3) Vista 2800 Acriglo Acrylic Flat
- d. Topcoat: Latex, exterior, low sheen.
  - 1) Dunn-Edwards, Spartashield SSHL40 Low Sheen.
  - 2) A-100 Acrylic Low Sheen, A12.
  - 3) Vista 1750 Acriglo Acrylic Low Sheen.
- e. Topcoat: Latex, exterior, semi-gloss.
  - 1) Dunn-Edwards, Spartashield SSHL50 Semi-Gloss.
  - 2) S-W A-100 Satin, A82
  - 3) Vista 7000 Acriglo Acrylic Semigloss
- f. Topcoat: Latex, exterior, gloss.
  - 1) Dunn-Edwards Spartashield SSHL60 Gloss.
  - 2) S-W A-100 Gloss, A8.
  - 3) Vista 8500 Carefree Gloss.
- 2. Medium to High-Build Latex System: Dry film thickness of 8-10 mils DFT (medium-build), or 12-15 mils DFT (high-build).
  - a. Prime Coat: As recommended in writing by topcoat manufacturer.
  - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - c. Topcoat: Latex, exterior, medium to high build.
    - 1) Dunn-Edwards EDLX10 Enduralastic 10 Elastomeric.
    - 2) S-W Conflex XL Smooth CF16 Series (high-build).

- 3) Vista 1900 Weather Master (medium-build), or Vista 500 Solotex (high-build).

D. CMU Substrates:

1. Latex System:

- a. Prime Coat: Block filler, latex, interior/exterior.
  - 1) Dunn-Edwards, Blocfil Block Filler SBSL00 Primer.
  - 2) S-W Preprite Block Filler, B25W25.
  - 3) Vista 040 Block Kote Block Filler.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, flat.
  - 1) Dunn-Edwards, Spartshield SSHL10 Flat.
  - 2) S-W A-100 Acrylic Flat, A6.
  - 3) Vista 2800 Acriglo Acrylic Flat
- d. Topcoat: Latex, exterior, low sheen.
  - 1) Dunn-Edwards, Spartashield SSHL40 Low Sheen.
  - 2) A-100 Acrylic Low Sheen, A12.
  - 3) Vista 1750 Acriglo Acrylic Low Sheen
- e. Topcoat: Latex, exterior, semi-gloss.
  - 1) Dunn-Edwards, Spartashield SSHL50 Semigloss.
  - 2) S-W A-100 Satin, A82.
  - 3) Vista 7000 Acriglo Acrylic Semigloss
- f. Topcoat: Latex, exterior, gloss.
  - 1) Dunn-Edwards Spartashield SSHL60 Gloss.
  - 2) S-W A-100 Gloss, A8.
  - 3) Vista 8500 Carefree Gloss.

2. Medium to High-Build Latex System: Dry film thickness of 8-10 mils DFT (medium-build), or 12-15 mils DFT (high-build).
  - a. Prime Coat: As recommended in writing by topcoat manufacturer.
  - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
  - c. Topcoat: Latex, exterior, medium to high build.
    - 1) Dunn-Edwards EDLX10 Enduralastic 10 Elastomeric.
    - 2) S-W Conflex XL Smooth CF16 Series (high-build).
    - 3) Vista 1900 Weather Master (medium-build), or Vista 500 Solotex (high-build).

E. Steel and Iron Substrates:

1. Water-Based Light Industrial Coating over Rust Inhibitive Acrylic Primer System:
  - a. Prime Coat: Primer, rust inhibitive, water-based.
    - 1) Dunn-Edwards ENPR00 Enduraprime.
    - 2) S-W ProCryl Acrylic Metal Primer, B66W310.
    - 3) Vista 4800 Metal Pro Primer.
  - b. Intermediate Coat: Light industrial coating, exterior, water-based matching topcoat.
  - c. Topcoat: Light industrial coating, exterior, water based, low sheen.
    - 1) Dunn-Edwards Aristoshield ASHL40 Low Sheen.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
    - 3) Vista 9700 Protec Satin
  - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss.
    - 1) Dunn-Edwards Aristoshield ASHL50 Semigloss.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
    - 3) Vista 9800 Protec Semi-Gloss
  - e. Topcoat: Light industrial coating, exterior, water based, gloss.

- 1) Dunn-Edwards Aristoshield ASHL70 Gloss, or Endura-Coat ENCT 60 Gloss.
- 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
- 3) Vista 9900 Protec Gloss

F. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:
2. Surface Prep: Krud Kutter Metal Clean & Etch
  - a. Prime Coat: Primer, galvanized, water based.
    - 1) Dunn-Edwards Ultrashield Galvanized Metal Primer ULGM00.
    - 2) S-W ProCryl Acrylic Metal Primer, B66W310.
    - 3) Vista 4800 Metal Pro Primer
  - b. Intermediate Coat: Light industrial coating, exterior, water-based matching topcoat.
  - c. Topcoat: Light industrial coating, exterior, water based, low sheen.
    - 1) Dunn-Edwards Aristoshield ASHL40 Low Sheen.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
    - 3) Vista 9700 Protec Satin
  - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss.
    - 1) Dunn-Edwards Aristoshield ASHL50 Semigloss.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
    - 3) Vista 9800 Protec Semi-Gloss
  - e. Topcoat: Light industrial coating, exterior, water based, gloss.
    - 1) Dunn-Edwards Aristoshield ASHL70 Gloss.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
    - 3) Vista 9900 Protec Gloss

G. Aluminum Substrates:

1. Water-Based Light Industrial Coating System:

- a. Prime Coat: Primer, aluminum, water-based.
  - 1) Dunn-Edwards Ultrashield Galvanized Metal Primer ULGM00.
  - 2) S-W ProCryl Acrylic Metal Primer, B66W310.
  - 3) Vista 4800 Metal Pro Primer
- a. Intermediate Coat: Light industrial coating, exterior, water-based matching topcoat.
- b. Topcoat: Light industrial coating, exterior, water based, low sheen or eggshell.
  - 1) Dunn-Edwards Aristoshield ASHL40 Low Sheen.
  - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
  - 3) Vista 9700 Protec Satin
- c. Topcoat: Light industrial coating, exterior, water based, semi-gloss.
  - 1) Dunn-Edwards Aristoshield ASHL50 Semigloss.
  - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
  - 3) Vista 9800 Protec Semi-Gloss
- d. Topcoat: Light industrial coating, exterior, water based, gloss.
  - 1) Dunn-Edwards Aristoshield ASHL70 Gloss.
  - 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
  - 3) Vista 9900 Protec Gloss

H. Wood Substrates: Exposed framing.

1. Latex over Latex Primer System:

- a. Prime Coat: Primer, waterbased exterior.
  - 1) Dunn-Edwards EZ Prime Premium EZPR00 or UGPR00 Ultra Grip Primer.

- 2) S-W Preprite ProBlock Primer, B51 Series.
    - 3) Vista 4200 Terminator II
  - b. Intermediate Coat: Latex, exterior, matching topcoat.
  - c. Topcoat: Latex, exterior, flat.
    - 1) Dunn-Edwards Spartashield SSL10 Flat.
    - 2) S-W A-100 Acrylic Flat, A6.
    - 3) Vista 2800 Acriglo Acrylic Flat
  - d. Topcoat: Latex, exterior, low sheen.
    - 1) Dunn-Edwards Spartashield SSL40 Low Sheen.
    - 2) A-100 Acrylic Low Sheen, A12.
    - 3) Vista 1750 Acriglo Acrylic Low Sheen
  - e. Topcoat: Latex, exterior, semi-gloss.
    - 1) Dunn-Edwards Spartashield SSL50 Semigloss.
    - 2) S-W A-100 Satin, A82.
    - 3) Vista 7000 Acriglo Acrylic Semigloss
  - f. Topcoat: Latex, exterior, gloss.
    - 1) Dunn-Edwards Spartashield SSL60 Gloss.
    - 2) S-W A-100 Gloss, A8.
    - 3) Vista 8500 Carefree Gloss.
- I. Wood Substrates: Wood trim.
  - 1. Light industrial coating, exterior, water based over Latex Primer System:
    - a. Prime Coat: Primer, latex for exterior wood.
      - 1) Dunn-Edwards EZ-Prime Premium EZPR00 or UGPR00 Ultra Grip Primer.
      - 2) S-W Preprite ProBlock Primer, B51 Series.
      - 3) Vista 4200 Terminator II Primer.

- b. Intermediate Coat: Light industrial coating, exterior, water-based matching topcoat.
  - c. Topcoat: Light industrial coating, exterior, water based, low sheen.
    - 1) Dunn-Edwards Aristoshield ASHL40 Low Sheen.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
    - 3) Vista 5730 Polytec Water-based Polyurethane Eggshell.
  - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss.
    - 1) Dunn-Edwards Aristoshield ASHL50 Semigloss.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
    - 3) Vista 5740 Polytec Water-based Polyurethane Semigloss.
  - e. Topcoat: Light industrial coating, exterior, water based, gloss.
    - 1) Dunn-Edwards Aristoshield ASHL70.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
- J. Fiberglass Substrates:
- 1. Latex System:
    - a. Prime Coat: Primer, bonding, water based.
      - 1) Dunn-Edwards XIM UMA Primer.
      - 2) S-W Extreme Bond, B51W150.
      - 3) Vista 8600 Polytec Primer.
    - a. Intermediate Coat: Latex, exterior, matching topcoat.
    - b. Topcoat: Latex, exterior, flat.
      - 1) Dunn-Edwards Spartashield Flat SSSL10.
      - 2) S-W A-100 Acrylic Flat, A6.
      - 3) Vista 2800 Acriglo Acrylic Flat.
    - c. Topcoat: Latex, exterior, low sheen.



- 1) Dunn-Edwards Spartashield Low Sheen SSSL40.
  - 2) A-100 Acrylic Low Sheen, A12.
  - 3) Vista 1750 Acriglo Acrylic Low Sheen.
  - d. Topcoat: Latex, exterior, semi-gloss.
    - 1) Dunn-Edwards Spartashield Semigloss SSSL50.
    - 2) S-W A-100 Satin, A82.
    - 3) Vista 7000 Acriglo Acrylic Semigloss.
  - e. Topcoat: Latex, exterior, gloss.
    - 1) Dunn-Edwards Spartashield SSSL60 Gloss.
    - 2) S-W A-100 Gloss, A8.
    - 3) Vista 8500 Carefree Gloss.
- K. Plastic Trim Fabrication Substrates:
1. Latex System:
    - a. Prime Coat: Primer, bonding, water based.
      - 1) Dunn-Edwards XIM UMA Primer.
      - 2) S-W Extreme Bond, B51W150.
      - 3) Vista 8600 Polytec Primer.
    - a. Intermediate Coat: Latex, exterior, matching topcoat.
    - b. Topcoat: Latex, exterior, flat.
      - 1) Dunn-Edwards Spartashield Flat SSSL10.
      - 2) S-W A-100 Acrylic Flat, A6.
      - 3) Vista 2800 Acriglo Acrylic Flat.
    - c. Topcoat: Latex, exterior, low sheen.
      - 1) Dunn-Edwards Spartashield Low Sheen SSSL40.
      - 2) A-100 Acrylic Low Sheen, A12.

- 3) Vista 1750 Acriglo Acrylic Low Sheen.
- d. Topcoat: Latex, exterior, semi-gloss.
  - 1) Dunn-Edwards Spartashield Semigloss SSHL50.
  - 2) S-W A-100 Satin, A82.
  - 3) Vista 7000 Acriglo Acrylic Semigloss.
- e. Topcoat: Latex, exterior, gloss.
  - 1) Dunn-Edwards Spartashield SSHL60 Gloss.
  - 2) S-W A-100 Gloss, A8.
  - 3) Vista 8500 Carefree Gloss.
- L. Portland Cement Plaster Substrates:
  - 1. Latex System:
    - a. Prime Coat: Primer, alkali resistant, water based, interior/exterior.
      - 1) Dunn-Edwards Eff-Stop Select ESSL00.
      - 2) S-W Loxon Concrete Masonry Primer, LX2W50.
      - 3) Vista 4600 Uniprime II
    - a. Intermediate Coat: Latex, exterior, matching topcoat.
    - b. Topcoat: Latex, exterior, flat.
      - 1) Dunn-Edwards Spartashield SSHL10.
      - 2) S-W A-100 Acrylic Flat, A6.
      - 3) Vista 2800 Acriglo Acrylic Flat.
    - c. Topcoat: Latex, exterior, low sheen.
      - 1) Dunn-Edwards Spartashield SSHL40.
      - 2) A-100 Acrylic Low Sheen, A12.
      - 3) Vista 1750 Acriglo Acrylic Low Sheen.
    - d. Topcoat: Latex, exterior, semi-gloss.

- 1) Dunn-Edwards Spartashield Semigloss SSSL50.
    - 2) S-W A-100 Satin, A82.
    - 3) Vista 7000 Acriglo Acrylic Semigloss.
  - e. Topcoat: Latex, exterior, gloss.
    - 1) Dunn-Edwards Spartashield Gloss SSSL60.
    - 2) S-W A-100 Gloss, A8.
    - 3) Vista 8500 Carefree Gloss.
- M. Exterior Gypsum Board Substrates:
  1. Latex System:
    - a. Prime Coat: Primer, waterbased interior/exterior.
      - 1) Dunn-Edwards Ultra-Grip Select UGSL00.
      - 2) S-W Preprite ProBlock Primer, B51 Series.
      - 3) Vista 4200 Terminator II
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, flat.
      - 1) Dunn-Edwards Spartashield SSSL10.
      - 2) S-W A-100 Acrylic Flat, A6.
      - 3) Vista 2800 Acriglo Acrylic Flat.
    - d. Topcoat: Latex, exterior, low sheen.
      - 1) Dunn-Edwards Spartashield SSSL40.
      - 2) A-100 Acrylic Low Sheen, A12.
      - 3) Vista 1750 Acriglo Acrylic Low Sheen.
    - e. Topcoat: Latex, exterior, semi-gloss.
      - 1) Dunn-Edwards Spartashield SSSL50.
      - 2) S-W A-100 Satin, A82.

- 3) Vista 7000 Acriglo Acrylic Semigloss.
- f. Topcoat: Latex, exterior, gloss.
  - 1) Dunn-Edwards Spartashield SSSL60.
  - 2) S-W A-100 Gloss, A8.
  - 3) Vista 8500 Carefree Gloss.

END OF SECTION 09 91 13

## SECTION 09 91 23 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
- B. Related Requirements:
  - 1. Section 05 12 00 "Structural Steel Framing" for shop priming structural steel.
  - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
  - 3. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.
  - 4. Section 09 96 00 "High-Performance Coatings" for tile-like coatings.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Indicate VOC content.
- B. Sustainable Design Submittals:
  - 1. Emissions testing results indicating paint products VOC being in compliance with VOC limits of South Coast Air Quality Management District Rule 1113 "Architectural Coatings."
    - a. Flat Coatings: 50 g/L.
    - b. Nonflat Coatings: 50 g/L.
    - c. Waterproofing Concrete/Masonry Sealers: 100 g/L.
    - d. Primers, Sealers and Undercoaters: 100 g/L.
    - e. Rust Preventative Coatings: 100 g/L.
    - f. Industrial Maintenance Coatings: 100 g/L.
    - g. Stains, Interior: 250 g/L.
    - h. Wood coatings: 275 g/L.
  - 2. Provide Green Guard GOLD Certificate, VOC Emissions Testing AND TDS/SDS.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

### 1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to City.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

### 1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore and Co.
  - 2. Dunn-Edwards Corporation (a Nippon Paint Holdings Co. Ltd. company).
  - 3. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
  - 4. Sherwin-Williams Company (The).
  - 5. Vista Paint Corporation.
  - 6. Or equal.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. Colors: As indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Fiber-Cement Board: 12 percent.
  - 3. Masonry (Clay and CMUs): 12 percent.
  - 4. Wood: 15 percent.
  - 5. Gypsum Board: 12 percent.
  - 6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.



- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  1. Paint the following work where exposed in occupied spaces:
    - a. Panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.
  2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
  - 1. Institutional, Low-Odor/VOC Latex System:
    - a. Prime Coat: Primer sealer, interior, low odor/VOC.
      - 1) Dunn-Edwards Eff-Stop Select Primer ESSL00.
      - 2) S-W ProMar 200 Zero VOC Primer, B28W2600.
      - 3) Vista 5100 V-Pro Zero VOC Primer.
    - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, institutional low odor/VOC, flat.
      - 1) Dunn-Edwards Spartazero Zero VOC Flat SZR010.
      - 2) S-W ProMar 200 Zero VOC Flat, B30-2600.
      - 3) Vista 5100 V-Pro Zero VOC Flat.
    - d. Topcoat: Latex, interior, institutional low odor/VOC, eggshell.
      - 1) DunnEdwards Spartawall Zero VOC Eggshell SWLL30.
      - 2) S-W ProMar 200 Zero VOC Eg-shel, B20-2600.
      - 3) Vista 5300 V-Pro Zero VOC Eggshell.
    - e. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss.
      - 1) Dunn Edwards Spartawall Zero VOC Semigloss SWLL50.
      - 2) S-W ProMar 200 Zero VOC Semigloss, B31-2600.

- 3) Vista 5400 V-Pro Zero VOC Semigloss.
- f. Topcoat: Latex, interior, institutional low odor/VOC, gloss.
  - 1) Dunn-Edwards Spartashield Gloss SSSL60.
  - 2) S-W ProMar 200 Zero VOC Gloss, B21-12650.
- B. Concrete Substrates, Traffic Surfaces:
  1. Clear, Water-Based, penetrating, inorganic silicate-base solution:
    - a. First Coat: Monopole, Inc.; Monochem Aquaseal W20.
    - b. Topcoat: Monopole, Inc.; Monochem Aquaseal W20.
  2. Clear, Water-Based, penetrating, lithium silicate with siliconate water and salt repellent:
    - a. First Coat: Concrete Sealers USA; PS104.
    - b. Topcoat: Concrete Sealers USA; PS104.
- C. Concrete Substrates, Traffic Surfaces in IDF, computer rooms, and other rooms where anti-static floor finish is required:
  1. Water-Based Anti-Static ESD control sealer: Water based. Tested to ANSI S7.1 (PTG and RTG) @ 100VDC: <1.0 x 10E9 at >45% RH. VOC: 55 g/L. Static Dissipation: < 0.02 Sec.
    - a. First Coat: United Static Control Products; ElectraSeal.
    - b. Topcoat: United Static Control Products; ElectraSeal.
- D. CMU Substrates:
  1. Institutional Low-Odor/VOC Latex System:
    - a. Block Filler: Block filler, latex, interior/exterior.
      - 1) Dunn-Edwards Blocfil Select SBSL00.
      - 2) S-W Preprite Block Filler, B25W25.
      - 3) Vista 040 Block Kote Acrylic Block Filler
    - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
    - c. Topcoat: Latex, interior, institutional low odor/VOC, flat.
      - 1) Dunn-Edwards Spartawall Zero VOC Flat SWLL10.
      - 2) S-W ProMar 200 Zero VOC Flat, B30-2600.
      - 3) Vista 5100 V-Pro Zero VOC Flat.
    - d. Topcoat: Latex, interior, institutional low odor/VOC, eggshell.
      - 1) Dunn-Edwards Spartawall Zero VOC Eggshell SWLL30.

- 2) S-W ProMar 200 Zero VOC Eg-shel, B20-2600.
    - 3) Vista 5300 V-Pro Zero VOC Eggshell.
  - e. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss.
    - 1) Dunn-Edwards Spartawall Zero VOC Semi Gloss SWLL50.
    - 2) S-W ProMar 200 Zero VOC Semigloss, B31-2600.
    - 3) Vista 5400 V-Pro Zero VOC Semigloss.
  - f. Topcoat: Latex, interior, institutional low odor/VOC, gloss.
    - 1) Dunn-Edwards Spartashield Gloss SWLL60.
    - 2) S-W ProMar 200 Zero VOC Gloss, B21-12650.
- E. Steel Substrates:
  - 1. Water-Based Light Industrial Coating System:
    - a. Prime Coat: Primer, rust-inhibitive, water based.
      - 1) Dunn-Edwards Bloc-Rust Primer BRPR00.
      - 2) S-W ProCryl Acrylic Metal Primer, B66W310.
      - 3) Vista 9600 Protec Metal.
    - b. Intermediate Coat: Light industrial coating, interior, water-based matching topcoat.
    - c. Topcoat: Light industrial coating, interior, water based, low sheen.
      - 1) Dunn-Edwards Aristoshield Urethane ASHL40 Low Sheen.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
      - 3) Vista 9700 Protec Satin
    - d. Topcoat: Light industrial coating, interior, water based, semi-gloss.
      - 1) Dunn-Edwards Aristoshield Urethane S/G ASHL50 or Endura-Coat ENCT50 Semigloss.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
      - 3) Vista 9800 Protec Semi-Gloss
    - e. Topcoat: Light industrial coating, interior, water based, gloss.
      - 1) Dunn-Edwards Aristoshield ASHL70 Gloss or Endura-Coat ENCT60 Gloss.

- 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
    - 3) Vista 9900 Protec Gloss
  2. Water-Based Dry-Fall System:
    - a. Spot Prime Existing Rust: Primer, rust-inhibitive, water based.
      - 1) Dunn-Edwards Endura-Prime ENPR00 Primer.
      - 2) S-W ProCryl Acrylic Metal Primer, 66W310.
      - 3) Vista 9600 Protec Metal Primer.
    - b. Intermediate Coat: Dry fall, water based, latex, flat, matching topcoat.
    - c. Topcoat: Dry fall, water based, latex, flat.
      - 1) Dunn-Edwards AQUAFALL Dry Fall Flat AQUA10.
      - 2) S-W ProIndustrial Waterborne Acrylic Dryfall, B42W181.
      - 3) Vista DF12 Acrylic Dryfall.
- F. Galvanized-Metal Substrates:
  1. Water-Based Light Industrial Coating System:
    - a. Surface Prep: Krud Kutter Metal Clean & Etch
    - b. Prime Coat: Primer, galvanized, water based.
      - 1) Dunn-Edwards Ultra Grip Primer UGPR00.
      - 2) S-W ProCryl Acrylic Metal Primer, B66W310.
      - 3) Vista 4800 Metal Pro Primer
    - a. Intermediate Coat: Light industrial coating, interior, water-based matching topcoat.
    - b. Topcoat: Light industrial coating, interior, water based, low sheen.
      - 1) Dunn-Edwards Aristoshield ASHL40 Low Sheen.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
      - 3) Vista 9700 Protec Satin
    - c. Topcoat: Light industrial coating, interior, water based, semi-gloss.
      - 1) Dunn-Edwards Aristoshield Urethane Semigloss ASHL50.

- 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
    - 3) Vista 9800 Protec Semi-Gloss
  - d. Topcoat: Light industrial coating, interior, water based, gloss.
    - 1) Dunn-Edwards Aristoshield Urethane Gloss ASHL70 or Endura-Coat Gloss ENCT60.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
    - 3) Vista 9900 Protec Gloss
2. Water-Based Dry-Fall System:
  - a. Prime Coat; Dry fall, water based, latex, flat, matching topcoat.
    - 1) Dunn-Edwards AQUAFALL Dry Fall Flat AQUA10.
    - 2) S-W ProIndustrial Waterborne Acrylic Dryfall, B42W181.
    - 3) Vista DF12 Acrylic Dryfall.
  - b. Topcoat: Dry fall, water based, latex, flat.
    - 1) Dunn-Edwards AQUAFALL Dry Fall Flat AQUA10.
    - 2) S-W ProIndustrial Waterborne Acrylic Dryfall, B42W181.
    - 3) Vista DF12 Acrylic Dryfall.
- G. Aluminum (Not Anodized or Otherwise Coated) Substrates:
  1. Water-Based Light Industrial Coating System:
    - a. Prime Coat: Primer, water based, for aluminum.
      - 1) Dunn-Edwards Ultra Grip Primer UGPR00.
      - 2) S-W ProCryl Acrylic Metal Primer, B66W310.
      - 3) Vista 4800 Metal Pro Primer
    - b. Intermediate Coat: Light industrial coating, interior, water-based matching topcoat.
    - c. Topcoat: Light industrial coating, interior, water based, low sheen.
      - 1) Dunn-Edwards Aristoshield Urethane ASHL40 Low Sheen.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
      - 3) Vista 9700 Protec Satin



- d. Topcoat: Light industrial coating, interior, water based, semi-gloss.
    - 1) Dunn-Edwards Aristoshield Urethane Semigloss ASHL50.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
    - 3) Vista 9800 Protec Semigloss.
  - e. Topcoat: Light industrial coating, interior, water based, gloss.
    - 1) Dunn-Edwards Aristoshield Urethane Gloss ASHL70.
    - 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.
    - 3) Vista 9900 Protec Gloss
- H. Wood Substrates: Wood trim.
- 1. Water-Based Light Industrial Coating System:
    - a. Prime Coat: Primer sealer, latex, interior.
      - 1) Dunn-Edwards Block-IT Primer BIPR00.
      - 2) S-W Preprite ProBlock Primer, B51 Series.
      - 3) Vista 4200 Terminator II
    - b. Intermediate Coat: Light industrial coating, interior, water-based matching topcoat.
    - c. Topcoat: Light industrial coating, interior, water based, low sheen.
      - 1) Dunn-Edwards Aristoshield Urethane ASHL40 Low Sheen.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Low Sheen, B53-1250.
      - 3) Vista 5730 Polytec Water-based Polyurethane Eggshell.
    - d. Topcoat: Light industrial coating, interior, water based, semi-gloss.
      - 1) Dunn-Edwards Aristoshield Urethane Semi Gloss ASHL50.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Semigloss, B53-1150.
      - 3) Vista 5740 Polytec Water-based Polyurethane Semigloss.
    - e. Topcoat: Light industrial coating, interior, water based, gloss.
      - 1) Dunn-Edwards Aristoshield Urethane Gloss ASHL70 or ENCT60.
      - 2) S-W ProIndustrial Water-based Alkyd Urethane Gloss, B53-1050.

I. Fiberglass Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer, bonding, water based.
  - 1) Dunn-Edwards XIM UMA Primer (test on specific plastic substrates).
  - 2) S-W Extreme Bond, B51W150.
  - 3) Vista 8600 Polytec Primer.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, flat.
  - 1) Dunn-Edwards Spartawall Zero VOC Flat SWLL10.
  - 2) S-W ProMar 200 Zero VOC Flat, B30-2600.
  - 3) Vista 5100 V-Pro Zero VOC Flat.
- d. Topcoat: Latex, interior, institutional low odor/VOC, eggshell.
  - 1) Dunn-Edwards Spartawall Zero VOC Eggshell SWLL30.
  - 2) S-W ProMar 200 Zero VOC Eg-shel, B20-2600.
  - 3) Vista 5300 V-Pro Zero VOC Eggshell.
- e. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss.
  - 1) Dunn-Edwards Spartawall Zero VOC Semigloss SZR050.
  - 2) S-W ProMar 200 Zero VOC Semigloss, B31-2600.
  - 3) Vista 5400 V-Pro Zero VOC Semigloss.
- f. Topcoat: Latex, interior, institutional low odor/VOC, gloss.
  - 1) Dunn-Edwards Spartashield Gloss SSSL60.
  - 2) S-W ProMar 200 Zero VOC Gloss, B21-12650.

J. Plastic Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer, bonding, water based.
  - 1) Dunn-Edwards XIM UMA Primer (test on specific plastic substrates).

- 2) S-W Extreme Bond, B51W150.
- 3) Vista 8600 Polytec Primer.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, flat.
  - 1) Dunn-Edwards Spartawall Zero VOC SWLL10 Flat.
  - 2) S-W ProMar 200 Zero VOC Flat, B30-2600.
  - 3) Vista 5100 V-Pro Zero VOC Flat.
- d. Topcoat: Latex, interior, institutional low odor/VOC, eggshell.
  - 1) Dunn-Edwards Spartawall Zero VOC Eggshell SWLL30.
  - 2) S-W ProMar 200 Zero VOC Eg-shel, B20-2600.
  - 3) Vista 5300 V-Pro Zero VOC Eggshell.
- e. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss.
  - 1) Dunn-Edwards Spartawall Zero VOC Semigloss SWLL50.
  - 2) S-W ProMar 200 Zero VOC Semigloss, B31-2600.
  - 3) Vista 5400 V-Pro Zero VOC Semigloss.
- f. Topcoat: Latex, interior, institutional low odor/VOC, gloss.
  - 1) Dunn-Edwards Spartashield Gloss SSSL60.
  - 2) S-W ProMar 200 Zero VOC Gloss, B21-12650.

K. Gypsum Board and Plaster Substrates:

- 1. Institutional Low-Odor/VOC Latex System:
  - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC.
    - 1) Dunn Edwards Vinylastic Zero VOC Select Primer VNLSL00.
    - 2) S-W ProMar 200 Zero VOC Primer, B28W2600.
    - 3) Vista 5001 V-Pro Zero VOC Primer.
  - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  - c. Topcoat: Latex, interior, institutional low odor/VOC, flat.
    - 1) Dunn-Edwards Spartawall Zero VOC Flat SWLL10.

- 2) S-W ProMar 200 Zero VOC Flat, B30-2600.
    - 3) Vista 5100 V-Pro Zero VOC Flat.
  - d. Topcoat: Latex, interior, institutional low odor/VOC, eggshell.
    - 1) Dunn-Edwards Spartawall Zero VOC Eggshell SWLL30.
    - 2) S-W ProMar 200 Zero VOC Eg-shel, B20-2600.
    - 3) Vista 5300 V-Pro Zero VOC Eggshell.
  - e. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss.
    - 1) Dunn-Edwards Spartawall Zero VOC Semigloss SWLL50.
    - 2) S-W ProMar 200 Zero VOC Semigloss, B31-2600.
    - 3) Vista 5400 V-Pro Zero VOC Semigloss.
  - f. Topcoat: Latex, interior, institutional low odor/VOC, gloss.
    - 1) Dunn-Edwards Spartashield Gloss SSSL60.
    - 2) S-W ProMar 200 Zero VOC Gloss, B21-12650.
2. Low Odor/Zero VOC, Pre-catalyzed, waterborne acrylic epoxy over acrylic primer (Kitchen, Dry Storage) designated as "GB-EBX" on drawings.
  - a. Prime Coat: W.B. PVA Sealer, or Vinyl Acrylic Primer.
    - 1) Dunn-Edwards; Vinylastic Premium VNPR00
    - 2) PPG; Speedhide MaxPrime Latex Primer/Surfacer; 6-4.
    - 3) Sherwin-Williams: Promar 200 Primer.
    - 4) Vista Paints: 5001 V-Pro Primer.
  - b. Intermediate Coat: Pre-catalyzed, waterborne acrylic epoxy, matching topcoat.
  - c. Topcoat: Pre-catalyzed, waterborne acrylic epoxy.
    - 1) Dunn-Edwards; Enduracat Pre-Catalyzed Waterbased Epoxy Semi-Gloss; ENPX50.
    - 2) PPG; Pitt-Glaze WB1 Pre-Catalyzed Acrylic Water-Borne Epoxy Semi-Gloss; 16-510 Series.
    - 3) Sherwin-Williams: Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss; K46W01151.

L. Cotton, Canvas, ASJ Insulation Covering Substrates:

1. Water-Based Dry-Fall System:

- a. Prime Coat; Dry fall, water based, latex, flat, matching topcoat.
  - 1) Dunn-Edwards AQUAFALL Dry Fall Flat AQUA10.
  - 2) S-W ProIndustrial Waterborne Acrylic Dryfall, B42W181.
  - 3) Vista DF12 Acrylic Dryfall.
- b. Topcoat: Dry fall, water based, latex, flat.
  - 1) Dunn-Edwards AQUAFALL Dry Fall Flat AQUA10.
  - 2) S-W ProIndustrial Waterborne Acrylic Dryfall, B42W181.
  - 3) Vista DF12 Acrylic Dryfall.

END OF SECTION 09 91 23

## SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
  - a. Concrete masonry units (CMUs).
  - b. Steel.
  - c. Galvanized metal.
  - d. Aluminum (not anodized or otherwise coated).
  - e. Copper.
2. Interior Substrates:
  - a. Concrete, vertical surfaces.
  - b. Concrete masonry units (CMUs).
  - c. Steel.
  - d. Galvanized metal.
  - e. Aluminum (not anodized or otherwise coated).
  - f. Gypsum board.

- B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
3. Section 09 91 13 "Exterior Painting" for general field painting.
4. Section 09 91 23 "Interior Painting" for general field painting.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Indicate VOC content.

- B. Sustainable Design Submittals:

1. Emissions testing results indicating paint products VOC being in compliance with VOC limits of South Coast Air Quality Management District Rule 1113 "Architectural Coatings."

- a. Flat Coatings: 50 g/L.
  - b. Nonflat Coatings: 50 g/L.
  - c. Waterproofing Concrete/Masonry Sealers: 100 g/L.
  - d. Primers, Sealers and Undercoaters: 100 g/L.
  - e. Rust Preventative Coatings: 100 g/L.
  - f. Industrial Maintenance Coatings: 100 g/L.
  - g. Stains, Interior: 250 g/L.
  - h. Wood coatings: 275 g/L.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
- 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

### 1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- 1. Coatings: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
- 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

### 1.5 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.



- C. Do not apply exterior coatings in snow, rain, fog, or mist.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carboline
  2. PPG Paints.
  3. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
  4. Sherwin-Williams Company (The).
  5. Tnemec Inc.
  6. Or equal.
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.

### 2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
  3. Products shall be of same manufacturer for each coat in a coating system.
- B. Colors: As selected by Architect from manufacturer's full range.

### 2.3 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: City reserves the right to invoke the following procedure:
1. City will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  2. Testing agency will perform tests for compliance with product requirements.

3. City may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Fiber-Cement Board: 12 percent.
  3. Masonry (Clay and CMUs): 12 percent.
  4. Gypsum Board: 12 percent.
  5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of

size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
1. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 7/NACE No. 4.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.
- H. Aluminum Substrates: Remove loose surface oxidation.

### 3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques suited for coating and substrate indicated.
  2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish

coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: City may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
  - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

### 3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. CMU Substrates:
  - 1. Pigmented Polyurethane over High-Build Epoxy System:
    - a. Block Filler: Block filler, epoxy.
      - 1) S-W Kem Cati-Coat HS, B42W100/B42V401.

- 2) Carboline Sanitile 500.
  - b. Intermediate Coat: Epoxy, high build, low gloss.
    - 1) S-W Macropoxy 646-100, B58-620/B58V620.
    - 2) Carboline Carboguard 890 VOC.
  - c. Topcoat: Polyurethane, two component, pigmented, gloss.
    - 1) S-W High Solids Polyurethane 250, B65J300/B60V30.
    - 2) Carboline Carbothane 134 VOC or Carbothane 134 MC (< 100 g/L VOC).
- B. Steel Substrates:
- 1. Pigmented Polyurethane over High-Build Epoxy System:
    - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
      - 1) S-W Macropoxy 646 Fast Cure Epoxy, B58 Series.
      - 2) Tnemec: High Build Epoxoline, 66HS.
      - 3) Carboline: Carboguard 890 VOC.
    - b. Intermediate Coat: Same as topcoat.
    - c. Topcoat: Polyurethane, two component, pigmented, gloss.
      - 1) Sherwin-Williams: S-W High Solids Polyurethane 250, B65J300/B60V30.
      - 2) Tnemec: Endura-shield Series 72.
      - 3) Carboline: Carbothane 134 Series Gloss.
- C. Galvanized-Metal Substrates:
- 1. Pigmented Polyurethane over Epoxy System:
    - a. Pretreatment of Galvanized steel surfaces.
    - b. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
      - 1) Sherwin-Williams: Macropoxy 646 Fast Cure Epoxy, B58 Series, or Recoatable Epoxy, B67A5/B67V5.

- 2) Tnemec: High Build Epoxoline, 66HS.
    - 3) Carboline Carboguard 890 VOC.
  - c. Intermediate Coat: Same as topcoat.
  - d. Topcoat: Polyurethane, two component, pigmented, gloss.
    - 1) Sherwin-Williams: Hi-Solids Polyurethane 250, B65J300/B60V30.
    - 2) Tnemec: Endura-shield Series 72.
    - 1) Carboline: Carbothane 134 Series Gloss.
- D. Aluminum (Not Anodized or Otherwise Coated) Substrates:
  - 1. Pigmented Polyurethane over Epoxy System:
    - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
      - 1) Sherwin-Williams: Macropoxy 646 Fast Cure Epoxy, B58 Series, or Recoatable Epoxy, B67A5/B67V5.
      - 2) Tnemec: High Build Epoxoline, 66HS.
      - 3) Carboline Carboguard 890 VOC.
    - b. Intermediate Coat: Same as topcoat.
    - c. Topcoat: Polyurethane, two component, pigmented, gloss.
      - 1) Sherwin-Williams: Hi-Solids Polyurethane 250, B65J300/B60V30.
      - 2) Tnemec: Endura-shield Series 72.
      - 3) Carboline: Carbothane 134 Series Gloss.

### 3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Vertical Surfaces:
  - 1. Epoxy-Modified Latex System:
    - a. Prime Coat: Primer sealer, latex, interior.
      - 1) Sherwin-Williams: S-W Preprite ProBlock Primer, B51 Series.
      - 2) Carboline Sanitile 120.

- b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
- c. Topcoat: Epoxy-modified latex, eggshell.
  - 1) S-W ProIndustrial Waterbased Catalyzed Epoxy, B73-300/B73V300.
- d. Topcoat: Epoxy-modified latex, gloss.
  - 1) S-W ProIndustrial Waterbased Catalyzed Epoxy, B73-360/B73V300.
  - 2) Carboline Sanitile 555 VOC.

B. CMU Substrates:

- 1. Epoxy-Modified Latex System:
  - a. Block Filler: Block filler, latex, interior/exterior.
    - 1) S-W ProIndustrial Heavy Duty Block Filler, B42W150.
    - 2) Carboline Sanitile 100.
  - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
  - c. Topcoat: Epoxy-modified latex, eggshell.
    - 1) S-W ProIndustrial Waterbased Catalyzed Epoxy, B73-300/B73V300.
  - d. Topcoat: Epoxy-modified latex, gloss.
    - 1) S-W ProIndustrial Waterbased Catalyzed Epoxy, B73-360/B73V300.
    - 2) Carboline Sanitile 555 VOC.

C. Steel Substrates:

- 1. Pigmented Polyurethane over High-Build Epoxy System:
  - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
    - 1) Sherwin-Williams: Macropoxy 646 Fast Cure Epoxy, B58 Series
    - 2) Tnemec: High Build Epoxoline, 66HS.
    - 3) Carboline Carboguard 890 VOC.
  - b. Intermediate Coat: Same as topcoat.
  - c. Topcoat: Polyurethane, two component, pigmented, gloss.



- 1) Sherwin-Williams: S-W High Solids Polyurethane 250, B65J300/B60V30.
- 2) Tnemec: Endura-shield Series 72.
- 3) Carboline: Carbothane 134 Series Gloss.

D. Galvanized-Metal Substrates:

1. Pigmented Polyurethane over High-Build Epoxy System:

- a. Pretreatment of Galvanized steel surfaces.
- b. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
  - 1) Sherwin-Williams: Macropoxy 646 Fast Cure Epoxy, B58 Series.
  - 2) Tnemec: High Build Epoxoline, 66HS.
  - 3) Carboline Carboguard 890 VOC.
- c. Intermediate Coat: Same as topcoat.
- d. Topcoat: Polyurethane, two component, pigmented, gloss.
  - 1) Sherwin-Williams: S-W High Solids Polyurethane 250, B65J300/B60V30.
  - 2) Tnemec: Endura-shield Series 72.
  - 3) Carboline: Carbothane 134 Series Gloss.

E. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Pigmented Polyurethane over High-Build Epoxy System:

- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal.
  - 1) Sherwin-Williams: Macropoxy 646 Fast Cure Epoxy, B58 Series
  - 2) Tnemec: High Build Epoxoline, 66HS
  - 3) Carboline Carboguard 890 VOC.
- b. Intermediate Coat: Same as topcoat.
- c. Topcoat: Polyurethane, two component, pigmented, gloss.

- 1) Sherwin-Williams: S-W High Solids Polyurethane 250, B65J300/B60V30.
- 2) Tnemec: Endura-shield Series 72.
- 3) Carboline: Carbothane 134 Series Gloss.

F. Gypsum Board, Plaster Substrates:

1. Epoxy-Modified Latex System:

- a. Prime Coat: Primer sealer, latex, interior.
  - 1) S-W ProMar 200 Zero VOC Primer, B28W2600.
  - 2) Carboline Sanitile 120.
- b. Intermediate Coat: Epoxy-modified latex, matching topcoat.
- c. Topcoat: Epoxy-modified latex, eggshell.
  - 1) S-W ProIndustrial Waterbased Catalyzed Epoxy, B73-300/B73V300.
- d. Topcoat: Epoxy-modified latex, gloss.
  - 1) S-W ProIndustrial Waterbased Catalyzed Epoxy, B73-360/B73V300.
  - 2) Carboline Carboseal 555 VOC.

END OF SECTION 09 96 00

## SECTION 10 11 00 - VISUAL DISPLAY UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Visual display board assemblies.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations acceptable to Architect.

#### 1.4 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Surfaces lose original writing and erasing qualities.
  - b. Surfaces exhibit crazing, cracking, or flaking.
2. Warranty Period:
  - a. Life of the building.

## PART 2 - PRODUCTS

### 2.1 VISUAL DISPLAY BOARD ASSEMBLIES

- A. Visual Display Board Assemblies: Indicated as Polyvision Whiteboard on Drawings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. PolyVision Corporation: CeramicSteel series 3630 (Basis of Design).
    - b. ASI Visual Display Products.
    - c. Claridge Products and Equipment, LLC.
    - d. Or equal.
- B. Visual Display Board Assembly: factory fabricated.
  - 1. Assembly: markerboard.
  - 2. Corners: Square.
  - 3. Width: As indicated on Drawings.
  - 4. Height: As indicated on Drawings.
  - 5. Mounting Method: Direct to wall.
- C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
  - 1. Color: White.
  - 2. Surface Gloss: Satin, Type S surface (Polyvision).
  - 3. Magnetic: Yes.
- D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.
  - 1. Aluminum Finish: Clear anodic finish.
- E. Combination Assemblies: Provide H-trim between abutting sections of visual display panels.
- F. Chalktray: Manufacturer's standard; continuous.
  - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

### 2.2 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

- B. Extruded Aluminum: **ASTM B221** (**ASTM B221M**), Alloy 6063.

## 2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.4 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.
- E. Prepare recesses for sliding visual display units as required by type and size of unit.

### 3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Factory-Fabricated Visual Display Board Assemblies:
  - 1. Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than **16 inches (400 mm)** o.c. Secure tops and bottoms of boards to walls.
- C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

### 3.4 CLEANING AND PROTECTION

- A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

## SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Cast dimensional characters.
2. Cutout dimensional characters.
3. Fabricated channel dimensional characters.
4. Illuminated, fabricated channel dimensional characters.
5. Molded-plastic dimensional characters.
6. Illuminated, molded-plastic dimensional characters.

#### 1.2 DEFINITIONS

- A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

#### 1.3 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show locations of electrical service connections.
4. Include diagrams for power, signal, and control wiring.

- C. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

- D. Delegated-Design Submittal: For signs indicated in "Performance Requirements" Article.



1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

## PART 2 - PRODUCTS

### 2.1 DIMENSIONAL CHARACTERS

- A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ACE Sign Systems, Inc.
    - b. ASI Sign Systems, Inc.
    - c. Gemini Incorporated.
    - d. Metallic Arts.
    - e. Or equal.
  2. Illuminated Characters: Backlighting character construction with LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
    - a. Power: As indicated on electrical Drawings.
    - b. Weeps: Provide weep holes to drain water at lowest part of exterior characters.
  3. Character Material: Sheet or plate aluminum.
  4. Material Thickness: Manufacturer's standard for size and design of character.
  5. Character Height: As indicated on Drawings.
  6. Character Depth: As indicated on Drawings.
  7. Finishes:
    - a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color matching City's sample.
    - b. Overcoat: Manufacturer's standard baked-on clear coating.
  8. Mounting: Concealed, stainless-steel back bar or bracket assembly.
    - a. Hold characters at 2-inch (51-mm) distance from wall surface.
  9. Typeface: As indicated.

## 2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

## 2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
  - 4. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
    - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
  - 1. <Double click to insert sustainable design text for VOC content of adhesive.>
  - 2. <Double click to insert sustainable design text for low emitting adhesives.>
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## 2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
  6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
  7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Stainless-Steel Brackets: Factory finish brackets with No. 4 finish unless otherwise indicated.

## 2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 2.6 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.7 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
  - 2. Directional Satin Finish: No. 4.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.

### 3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by City.

END OF SECTION 101419

## SECTION 10 14 23 - PANEL SIGNAGE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Panel signs.
2. Bond Act sign.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary informational and directional signs.

#### 1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.
- B. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

#### 1.3 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs, including Bond Act sign.
1. Include fabrication and installation details and sign panel attachments to sign post and sign post attachment to substrate.
  2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

- 4. Include diagrams for power, signal, and control wiring.
- C. Samples: For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

#### 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and California Building Code, Chapter 11B, the more stringent shall apply.

### 2.2 PANEL SIGNS

- A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASE, Inc.
    - b. All Star Signs, Inc.
    - c. ASI Sign Systems, Inc.
    - d. Clarke Systems.
    - e. Forms + Surfaces.
    - f. InPro Corporation (IPC).
    - g. Mohawk Sign Systems.
    - h. Vomar Products.
    - i. Or equal.
  - 2. Solid-Sheet Sign, Returns, and Back: Aluminum sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
    - a. Thickness: As indicated on Drawings.
    - b. Surface-Applied, Flat Graphics: Applied baked enamel or powder coat paint.
  - 3. Sign-Panel Perimeter: Finish edges smooth.
  - 4. Mounting: As indicated on Drawings.
  - 5. Text and Typeface: As indicated on drawings.
  - 6. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

### 2.3 BOND ACT SIGN

- A. Bond Act sign shall comply with panel signs article 2.2, and requirements listed below.
- B. Bond Act Sign:

1. A sign acknowledging the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 as the funding source for the project must be installed during construction and at completion (PRC §80001(b)(3)). If appropriate, the same sign can be used during construction and completion.

C. Sign Requirements:

1. The sign must be available during construction, at the final inspection of the PROJECT, and remain in place for a minimum of four (4) years from date of PROJECT completion. There is no minimum or maximum size other than the minimum size for the logo, as long as the sign contains the required wording.

D. Sign Language: All signs must contain the following language:

1. GAVIN NEWSOM, GOVERNOR Wade Crowfoot, Secretary for Natural Resources Armando Quintero, Director, California Department of Parks and Recreation
2. Use the names of the current officials. The name of the director of the local agency or other governing body may be added. The sign may also include names (and/or logos) of other partners, organizations, individuals and elected representatives.

E. Logo: All signs must display the Parks and Water Bond Act. Display the logo to maximize visibility and durability.

1. Logo Artwork:



2. Each edge of the logo must be a minimum of 24 by 24 inches. Exceptions may be approved, when appropriate, at OGALS' discretion.
- F. Sign Construction: All materials used shall be durable and resistant to the elements and graffiti.
- G. Sign Cost: Cost of permanent sign shall be included in Contractor's Base Bid.
- H. Appropriateness of Signs:
1. For projects where the required sign may be out of place or affected by local sign ordinances, OGALS may authorize a sign that is more appropriate to the project.
- I. State Approval:
1. Grantee shall submit the proposed number, locations, size, and language of signs for preliminary review. Final payments will not be processed until post completion signage has been approved and installed.

## 2.4 PANEL-SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

## 2.5 PANEL-SIGN POSTS

- A. Aluminum Pipe or tube: Seamless pipe and seamless extruded tube according to ASTM B241, 6061-T6.

## 2.6 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
    - a. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head, spanner-head or one-way-head slots unless otherwise indicated.
- B. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
  - 1. Uses: Securing signs with imposed loads to structure.
  - 2. Type: Torque-controlled, expansion anchor torque-controlled, adhesive anchor or adhesive anchor.
  - 3. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
- C. Adhesive: As recommended by sign manufacturer.
  - 1. Adhesives shall have a VOC content of 70 g/L or less.
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation

of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- D. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
- E. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.
- F. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.7 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
  - 6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

## 2.8 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 2.9 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Bond Act Sign: Install Bond Act Sign at a prominent location(s), outside of construction fence, visible to general public visiting El Dorado Park. Install Bond Act Sign prior to start of construction activities.
- C. Accessible Signage: Install in locations on walls as indicated on Drawings and according to the accessibility standard.
- D. Mounting Methods: Post mounted with mechanical fasteners.

### 3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by City.

END OF SECTION 10 14 23



## SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.

#### 1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

#### 1.3 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples : For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.

- B. Sample Warranty: For special warranty.

## 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and CBC Chapter 11B, the most stringent requirements shall take precedence.

## 2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign system with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ACE Sign Systems, Inc.
    - b. All Star Signs, Inc.
    - c. ASI Sign Systems, Inc.
    - d. Mohawk Sign Systems.
    - e. Seton Identification Products; a Brady Corporation company.
    - f. Vomar Products, Inc.
    - g. Or equal.
  2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
    - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
    - b. Surface-Applied Graphics: Applied vinyl film or photo image.
    - c. Subsurface Graphics: Reverse halftone or dot-screen image or Reverse etch image.
    - d. Color(s): As indicated or if not indicated to match facility signage standards.
  3. Sign-Panel Perimeter: Finish edges smooth.
  4. Mounting: Manufacturer's standard method for substrates indicated.
  5. Text and Typeface: As indicated or if not indicated to match facility signage standards. Finish raised characters to contrast with background color, and finish Braille to match background color.

## 2.3 SIGN MATERIALS

- A. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- D. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

## 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
    - b. Fastener Heads: Use oval countersunk screws and bolts with tamper-resistant Allen-head or spanner-head slots unless otherwise indicated.
  - 4. Sign Mounting Fasteners:
    - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
    - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
- D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.
- E. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

## 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.
- D. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Subsequent changeable inserts are by City. Furnish two blank inserts for each sign for City's use.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
  2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
  3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
  4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
  5. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
  6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

### 3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by City.

END OF SECTION 101423.16



## SECTION 10 21 13.19 - PLASTIC TOILET COMPARTMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid-plastic toilet compartments.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for blocking.
2. Section 09 22 16 "Non-Structural Metal Framing" for blocking.
3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

#### 1.2 COORDINATION

- A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Solid-plastic toilet compartments:
  - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show overhead support or bracing locations.

- C. Samples: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment.

1. Include Samples of hardware and accessories involving material and color selection.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.
- B. ptance criteria of, NFPA 286.
- C. Structural Performance: Where grab bars are mounted on toilet compartments, design panels to comply with the following requirements:
  - 1. Panels are able to withstand a concentrated load on grab bar of at least 250 lbf (1112 N) applied at any direction and at any point, without deformation of panel.
- D. Regulatory Requirements: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and cbc Chapter 11B for toilet compartments designated as accessible.

### 2.2 SOLID-PLASTIC TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Weis/Robart Partitions, Inc.; Weis/Poly HDPE Solid Polymer-Plastic, Anaheim, CA 92806. [www.weisrobert.com](http://www.weisrobert.com). Tel: (714) 666-0108, or (714) 666-0109.
  - 2. Or equal.
- B. Toilet-Enclosure Style: Overhead braced .
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) material, not less than 1 inch (25 mm) thick, seamless, with eased edges, and with homogenous color throughout thickness of material.
  - 1. Color: One color in each room as selected by Architect from manufacturer's full range.
- E. Urinal-Screen Construction: Matching panel construction.

### 2.3 HARDWARE AND ACCESSORIES

- A. Door Hardware and Accessories: Manufacturer's operating hardware and accessories.
  - 1. Hinges: Institutional 11 gauge ASTM A167 Type 304 stainless steel, surface mounted type. Self-closing adjustable to hold door open at any angle up to 90 degrees. Provide gravity type with opposing Duralon/nylon cams and captured

- pins. Hinges must be thru-bolted and provide emergency access without the use of any tool or key. Provide a total of three hinges per door.
2. Latch and Keeper: Manufacturers standard institutional latch, ASTM A167 Type 304 stainless steel, surface mounted. Stainless steel combination rubber faced keeper/bumper with emergency release feature mounted on pilaster and thru-bolted for maximum strength and security.
  3. Coat Hook: Manufacturers standard unit, combination hook and rubber tipped bumper, sized and placed to prevent door from hitting panels, walls or accessories.
  4. Door Pull: Manufacturers standard ASTM A167 Type 304 stainless steel unit for out swing doors. Provide out swing door bumper.
  5. Door Bumper: Manufacturer's rubber-tipped bumper at outswinging doors.
- B. Pilaster Shoes: Pilaster Shoes: ASTM A167 Type 304 stainless steel, not less than 4" high, 18 gauge, finished to match hardware.
- C. Brackets: 14 gauge ASTM A167 Type 304 stainless steel, chrome plated steel or anodized aluminum triple bracketing for substantial lateral support, thru-bolted to the panels.
- D. Overhead Bracing: Anodized aluminum continuous anti-grip profile channel to cap over top of pilasters. 3/16" aluminum wall thickness. Fasteners: All ASTM A167 Type 304 stainless steel or chrome plated one-way two part sexbolts for thru-bolting hardware. Stainless steel or chrome plated Phillips head screws at all wall connections.
- E. Inserts, T-nuts, or Jack nuts are not acceptable. All panels, pilasters, hinges, keepers, latches, and door pulls will be thru-bolted for maximum strength and security.
- 2.4 MATERIALS
- A. Aluminum Castings: ASTM B26/B26M.
  - B. Aluminum Extrusions: ASTM B221 (ASTM B221M).
  - C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
  - D. Stainless Steel Castings: ASTM A743/A743M.
- 2.5 FABRICATION
- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

- B. Overhead-Braced Units: Manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters and walls to suit floor and wall conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, inswinging doors for standard toilet enclosures and 36-inch- (914-mm-) wide, outswinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for toilet enclosures designated as accessible.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels or Screens: 1/2 inch (13 mm).
    - b. Panels or Screens and Walls: 1 inch (25 mm).
  - 2. Stirrup Brackets: Secure panels or screens to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel or screen.
    - a. Locate wall brackets, so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to

align tops of doors with tops of panels and adjust, so tops of doors are parallel with overhead brace when doors are in closed position.

- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

### 3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113.19

## SECTION 10 22 13 - WIRE MESH PARTITIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Standard-duty wire mesh partitions (indicated as mesh fencing at pump house).

#### 1.2 DEFINITIONS

- A. Intermediate Crimp: Wires pass over one and under the next adjacent wire in both directions, with wires crimped before weaving and with extra crimps between the intersections.
- B. Lock Crimp: Deep crimps at points of the intersection that lock wires securely in place.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Wire mesh partitions.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Indicate clearances required for operation of doors and gates.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acorn Wire & Iron Works.
2. American Warehouse Systems.
3. California Wire Products Corporation.
4. G-S Company (The).
5. Jesco Industries, Inc.
6. King Wire Partitions, Inc.

7. Standard Wire & Steel Works.
8. Or equal.

## 2.2 SOURCE LIMITATIONS

- A. For wire mesh products, obtain each color, grade, finish, type, and variety from single source with resources to provide products of consistent quality in appearance and physical properties.

## 2.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Wire mesh units to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
  1. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m) at any location on a panel.
  2. Total load of 200 lbf (0.89 kN) applied uniformly over each panel.
  3. Concentrated load and total load need not be assumed to act concurrently.
- B. Seismic Performance: Wire mesh units to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
- C. Regulatory Requirements: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and CBC Chapter 11B for doors and gates designated as accessible.

## 2.4 STANDARD-DUTY WIRE MESH PARTITIONS

- A. Mesh: 0.135-inch- (3.5-mm-) diameter, intermediate-crimp steel wire woven into 1-1/2-inch (38-mm) diamond mesh.
- B. Vertical Panel Framing: 1-1/4-by-5/8-by-0.080-inch (32-by-16-by-2.0-mm) cold-rolled, C-shaped steel channels with holes for 1/4-inch- (6-mm-) diameter bolts not more than 12 inches (300 mm) o.c.
- C. Posts for 90-Degree Corners: 1-1/4-by-1-1/4-by-1/8-inch (32-by-32-by-3.2-mm) steel angles or square tubes with holes for 1/4-inch- (6-mm-) diameter bolts aligning with bolt holes in vertical framing; with floor anchor clips.
- D. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch (32-by-13-by-3.2-mm) steel channels or 1-1/4-by-5/8-by-0.080-inch (32-by-16-by-2.0-mm) cold-rolled, C-shaped steel channels, banded with 1-1/4-by-1/8-inch (32-by-3.2-mm) flat steel bar cover plates on four sides, and with 1/8-inch- (3.2-mm-) thick angle strike bar and cover on strike jamb.
  1. Hinges: Full-surface type, 3-by-3-inch (76-by-76-mm) steel, three per door; bolted, riveted, or welded to door and jamb framing.



2. Cylinder Lock: Mortise type with cylinder specified in Section 087100 "Door Hardware"; operated by key outside and lever inside.
  3. Inactive Leaf Hardware: Cane bolt at bottom and chain bolt at top.
- E. Accessories:
1. Adjustable Filler Panels: 0.060-inch- (1.5-mm-) thick, steel sheet; capable of filling openings from 2 to 12 inches (50 to 300 mm).
  2. Wall Clips: Manufacturer's standard, steel sheet; allowing up to 1 inch (25 mm) of adjustment.
- F. Finish: Hot-dip galvanized and shop primed for field painting unless otherwise indicated.

## 2.5 MATERIALS

- A. Steel Wire: ASTM A510/A510M.
- B. Steel Plates, Channels, Angles, and Bars: ASTM A36/A36M.
- C. Steel Sheet: Cold-rolled steel sheet, ASTM A1008/A1008M, Commercial Steel (CS), Type B.
- D. Steel Pipe: ASTM A53/A53M, Schedule 40, unless another weight is indicated or required by structural loads.
- E. Steel Tubing: ASTM A500/A500M, cold-formed structural-steel tubing or ASTM A513/A513M, Type 5, mandrel-drawn mechanical tubing.
- F. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts, nuts, and washers.
- H. Post-Installed Anchors: Capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
  2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ISO 3506), and nuts, ASTM F594 (ASTM F836M).
- I. Power-Driven Fasteners: ICC-ES AC70.

- J. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- K. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

## 2.6 FABRICATION

- A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-sized components as recommended by wire mesh item manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.
  - 1. Fabricate wire mesh items to be readily disassembled.
  - 2. Welding: Weld corner joints of framing and remove spatter.
- B. Standard-Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
  - 1. Mesh: Weld mesh to framing.
  - 2. Framing: Fabricate framing with mortise-and-tenon corner construction.
    - a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
    - b. Fabricate three- and four-way intersections using intersection posts.
    - c. Fabricate partition and door framing with slotted holes for connecting adjacent panels.
  - 3. Fabricate wire mesh partitions with 3 to 4 inches (75 to 100 mm) of clear space between finished floor and bottom horizontal framing.
  - 4. Fabricate wire mesh partitions with bottom horizontal framing flush with finished floor.
  - 5. Doors: Align bottom of door with bottom of adjacent panels.
    - a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
  - 6. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

## 2.7 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
  - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean items of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to uncoated surfaces of wire mesh units unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where wire mesh items will be installed.
- C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF WIRE MESH PARTITIONS

- A. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (300 mm) o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.
  - 1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.
- B. Anchor wire mesh partitions to floor with 3/8-inch- (9.5-mm-) diameter, postinstalled expansion anchors at 12 inches (305 mm) o.c. through floor shoes located at each post

and corner. Adjust wire mesh partition posts in floor shoes to achieve level and plumb installation.

1. Anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if indicated on Shop Drawings.
- C. Anchor wire mesh partitions to walls at 12 inches (305 mm) o.c. through back corner panel framing and as follows:
  1. For concrete and solid masonry anchorage, use expansion anchors.
  2. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.
- D. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
- E. Install doors complete with door hardware.

### 3.3 REPAIR

- A. Repair Painting:
  1. Wire brush and clean rust spots, welds, and abraded areas immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
    - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
  2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas are included in Section 09 91 13 "Exterior Painting ."
- B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

### 3.4 ADJUSTING

- A. Adjust doors and gates to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Verify that latches and locks engage accurately and securely without forcing or binding.

### 3.5 PROTECTION

- A. Remove and replace defective work, including doors and framing that are warped, bowed, or otherwise unacceptable.

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END OF SECTION 10 22 13

## SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Underlavatory guards.
4. Custodial accessories.

B. Related Requirements:

1. Section 09 30 13 "Ceramic Tiling" for ceramic toilet and bath accessories.

#### 1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Underlavatory guards.
4. Custodial accessories.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Structural Performance: Design accessories and fasteners to comply with the following requirements:
  - 1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

### 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. Or equal.
  - 2. Description: Double-roll dispenser.
  - 3. Mounting: Recessed.
  - 4. Operation: Extra roll automatically drops in place when bottom roll is depleted. Depleted rolls can only be removed after unlocking door.
  - 5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
  - 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- C. Combination Towel (Folded) Dispenser/Waste Receptacle:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. Or equal.
  - 2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.



3. Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
  4. Mounting: Recessed.
    - a. Designed for nominal 4-inch (100-mm) wall depth.
  5. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
  6. Minimum Waste-Receptacle Capacity: 12 gal. (45.4 L).
  7. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  8. Liner: Disposable with accessory liner frame.
  9. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
- D. Soap Dispenser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
  2. Or equal
  3. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
  4. Mounting: Horizontally oriented, surface mounted.
  5. Capacity: 40 fl. oz.
  6. Materials: Stainless Steel, satin finish.
  7. Lockset: Tumbler type.
  8. Refill Indicator: Window type.
- E. Grab Bar:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. Or equal.
  2. Mounting: Flanges with concealed fasteners.
  3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
    - a. According to some manufacturers, a satin finish surface can provide slip-resistance performance similar to that of a textured surface.
    - b. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
  4. OD: 1-1/2 inches (38 mm).
  5. Configuration and Length: As indicated on Drawings.
- F. Sanitary-Napkin and Tampon Vendor:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ASI-American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.

- c. Bradley Corporation.
  - d. Or equal.
- 2. Mounting: Recessed
- 3. Operation: No coin (free).
- 4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
- 5. Lockset: Tumbler type with separate lock and key for coin box.

G. Sanitary-Napkin Disposal Unit:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI-American Specialties, Inc.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
  - d. Or equal.
- 2. Mounting: Surface mounted.
- 3. Door or Cover: Self-closing, disposal-opening cover.
- 4. Receptacle: Removable.
- 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

H. Sanitary-Napkin Disposal Unit:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI-American Specialties, Inc.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
  - d. Or equal.
- 2. Mounting: Fully recessed, designed for 4-inch (100-mm) wall depth.
- 3. Capacity: 1.2 gal. (4.6 L).
- 4. Door or Cover: Self-closing, disposal-opening cover.
- 5. Receptacle: Removable.
- 6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

I. Seat-Cover Dispenser:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI-American Specialties, Inc.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
  - d. Or equal.
- 2. Mounting: Surface mounted.
- 3. Minimum Capacity: 250 seat covers.
- 4. Exposed Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

5. Lockset: Tumbler type.

J. Mirror Unit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI-American Specialties, Inc.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
  - d. Or equal.
2. Frame: Stainless steel channel.
  - a. Corners: Mitered and mechanically interlocked.
3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

2.3 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.
- B. Diaper-Changing Station:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick:
    - b. ASI-American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Koala Kare Products; Bobrick Washroom Equipment, Inc.
    - e. Or equal.
  2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
    - a. Engineered to support minimum of 200 lb (91 kg) static load when opened.
  3. Mounting: Semirecessed.
  4. Operation: By pneumatic shock-absorbing mechanism.
  5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color.
  6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

## 2.4 UNDERLAVATORY GUARDS

### A. Underlavatory Guard :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Plumberex Specialty Products, Inc.
  - b. Truebro; IPS Corporation.
  - c. Or equal.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

## 2.5 CUSTODIAL ACCESSORIES

### A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

### B. Custodial Utility Shelf :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bobrick:
  - b. ASI-American Specialties, Inc.
  - c. Bradley Corporation.
  - d. Or equal.
2. Description: With exposed edges turned down not less than 1/2 inch (13 mm) and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
4. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, ASTM A480/A480M No. 4 finish (satin).

### C. Custodial Mop and Broom Holder :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ASI-American Specialties, Inc.
  - b. Bobrick Washroom Equipment, Inc.
  - c. Bradley Corporation.
  - d. Or equal.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
  - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.

- b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

## 2.6 MATERIALS

- A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- (0.9-mm-) minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.
- G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

## 2.7 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to City's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
  - 1. Remove temporary labels and protective coatings.

- B. Grab Bars: Install to comply with specified structural-performance requirements.
- C. Shower Seats: Install to comply with specified structural-performance requirements.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

## SECTION 10 44 13 - FIRE PROTECTION CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
  - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

#### 2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.; Ambassador series.
  - b. Larsen's Manufacturing Company; Architectural series.
  - c. Potter Roemer LLC; a Division of Morris Group International; Alta series.
  - d. Or equal.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semi recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
  1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Steel sheet .
- G. Door Style: Fully glazed panel with frame .
- H. Door Glazing Tempered break glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  1. Provide manufacturer's standard.
  2. Provide continuous hinge, of same material and finish as trim, , permitting door to open 180 degrees.
- J. Accessories:
  1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
  3. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
  4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
- K. Materials:
  1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

- a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
  - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - c. Color: Match Architect's sample As selected by Architect from manufacturer's full range.
2. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

## 2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  1. Weld joints and grind smooth.
  2. Miter corners and grind smooth.
  3. Provide factory-drilled mounting holes.
  4. Prepare doors and frames to receive locks.
  5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
  1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
  2. Fabricate door frames of one-piece construction with edges flanged.
  3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
  - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification:
  - 1. Apply decals at locations indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

## SECTION 104416 - FIRE EXTINGUISHERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
  - 1. Section 10 44 13 "Fire Protection Cabinets."

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

#### 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amerex Corporation.

- b. Ansul; brand of Johnson Controls International plc, Building Solutions North America.
  - c. [Babcock-Davis.](#)
  - d. [Guardian Fire Equipment, Inc.](#)
  - e. [J. L. Industries, Inc.; Activar Construction Products Group, Inc.](#)
  - f. [Kidde; Carrier Global Corporation.](#)
  - g. [Larsen's Manufacturing Company.](#)
  - h. Or equal.
- 2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
  - 3. Valves: Manufacturer's standard.
  - 4. Handles and Levers: Manufacturer's standard.
  - 5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container <Insert drawing designation>: UL-rated 4-A:60-B:C, **10-lb (4.5-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- C. Multipurpose Dry-Chemical Type in Aluminum Container <Insert drawing designation>: UL-rated 4-A:60-B:C, **10-lb (4.5-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

## 2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
- 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
  1. Mounting Height: Top of fire extinguisher to be at 42 inches (1067 mm) above finished floor.

END OF SECTION 10 44 16



## SECTION 10 75 29 - PLAZA-MOUNTED FLAGPOLES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes plaza-mounted flagpoles made from aluminum.
- B. City-Furnished Material: Flags.
- C. Related Requirements:
  - 1. Division 26 - Electrical for connecting plaza-mounted metal flagpoles to lightning protection system.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For each flagpole.
  - 1. Include the following:
    - a. Plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
    - b. Details of plaza-mounted connections and mountings, including setting drawings, templates and directions for installing anchorages that are to be embedded in concrete or masonry.
- C. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
- D. Delegated Design Submittals: For flagpoles.
  - 1. Include loads, point reactions, and locations for attachment of flagpoles to building's structure.

### 1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design flagpole assemblies.
- B. Seismic Performance: Flagpole assemblies to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Structural Performance: Flagpole assemblies, including anchorages and supports, to withstand design loads indicated within limits and under conditions indicated.
  - 1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is as indicated on Drawings.
  - 2. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

### 2.3 ALUMINUM FLAGPOLES

- A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 0.156 inch (17 mm).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Liberty Flagpoles; Architectural Elite Series (Basis of Design).
    - b. Eder Flag Manufacturing Co.

- c. American Flagpole.
  - d. Concord American Flagpole.
  - e. Pole-Tech Co., Inc.
  - f. US Flag & Flagpole Supply, LLC.
  - g. Or equal.
- B. Exposed Height: As indicated on Drawings.
- C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
  - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
  - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- D. Cast-Metal Shoe Base: Made from aluminum with same finish and color as flagpoles for anchor-bolt mounting; furnish with anchor bolts.
  - 1. Furnish connector to Park's lightning protection system conductor.

## 2.4 FITTINGS

- A. Finial Ball: Flush-seam ball, spun aluminum, 8 inch dia with gold anodized finish.
- B. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch- (8-mm-) diameter, braided polypropylene halyard and 9-inch (228-mm) cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
  - 1. Halyards and Cleats: One.
  - 2. Cleat Covers: Cast metal, finished to match flagpole, secured with cylinder locks.
  - 3. Halyard Covers: 2-inch (50-mm) channel, 60 inches (1500 mm) long, finished to match flagpole.
  - 4. Halyard Flag Snaps: Bronze swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.

## 2.5 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.
- B. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.6 ALUMINUM FINISHES

- A. Manufacturer's Satin Aluminum finish as indicated on Drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FLAGPOLE INSTALLATION

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Baseplate: Install baseplate on washers placed over leveling nuts on bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.
- C. Mounting Brackets and Bases: Anchor brackets and bases securely to structural support with fasteners as indicated on Shop Drawings.

END OF SECTION 10 75 29

## SECTION 12 24 13 - ROLLER WINDOW SHADES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Manually operated, single-roller shades.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

### PART 2 - PRODUCTS

#### 2.1 SOURCE LIMITATIONS

A. Obtain roller shades from single source from single manufacturer.

#### 2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper, Inc.
2. Hunter Douglas Architectural.
3. Lutron Electronics Co., Inc.

4. MechoShade Systems, LLC.
  5. Or equal.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Bead Chains: Manufacturer's standard .
    - a. Loop Length: Full length of roller shade.
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Clip, jamb mount.
  2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of interior face of shade.
  2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
1. Shadeband Material: Light-filtering fabric.
  2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Type: Enclosed in sealed pocket of shadeband material.
- F. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).

## 2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
  - 1. Source: Roller shade manufacturer.
  - 2. Product Category: Privacy.
  - 3. Type: Acrylic-coated fiberglass.
  - 4. Weave: Rib weave.
  - 5. Thickness: 0.013-inch (0.35 mm)  $\pm$  5%.
  - 6. Weight: 8.7 oz / yd<sup>2</sup> (295 g / m<sup>2</sup>)  $\pm$  5%.
  - 7. Roll Width: 94.5-inches (240 cm).
  - 8. Orientation on Shadeband: Up the bolt.
  - 9. Openness Factor: <1 percent.
  - 10. Color: As selected by Architect from manufacturer's full range.

## 2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
  - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
  - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
  - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.
- B. Roller Shade Locations: At exterior windows.

### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

### 3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

## SECTION 12 36 23.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.
2. Accessories.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-clad countertops.
2. Fire-retardant-treated materials.
3. Accessories.

B. Product Data Submittals: For each product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.
3. Apply WI Certified Compliance Program label to Shop Drawings.

D. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

E. Samples: For plastic laminates.

#### 1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: WI's Certified Compliance Program licensee.

- B. Installer Qualifications: WI's Certified Compliance Program licensee.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations with Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 20 and 50 percent during the remainder of the construction period.
- C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

### PART 2 - PRODUCTS

#### 2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from WI certification program indicating that countertops comply with requirements of grades specified.
  2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. High-Pressure Decorative Laminate: ISO 4586-3, Grade HGS.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by manufacturer's designations.
  2. Match Architect's sample.
  3. As selected by Architect from manufacturer's full range in the following categories:
    - a. Solid colors, matte finish.
    - b. Solid colors with core same color as surface, matte finish.
    - c. Wood grains, matte finish with grain running parallel to length of countertop.
    - d. Patterns, matte finish.
- D. Edge Treatment: Same as laminate cladding on horizontal surfaces .
- E. Core Material: Particleboard or MDF .
- F. Core Material at Sinks: MDF made with exterior glue or exterior-grade plywood.
- G. Core Thickness: 3/4 inch (19 mm).
1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.
- H. Backer Sheet: Provide plastic-laminate backer sheet, ISO 4586-3, grade to match exposed surface, on underside of countertop substrate.
- I. Paper Backing: Provide paper backing on underside of countertop substrate.
- 2.2 WOOD MATERIALS
- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
1. Wood Moisture Content: 4 to 9 percent.

- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.
  - 1. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.
  - 2. Particleboard: ANSI A208.1, Grade M-2.
  - 3. Softwood Plywood: DOC PS 1.

## 2.3 ACCESSORIES

- A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Outside Diameter: 2 inches (51 mm).
  - 2. Color: Black,

## 2.4 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: Type II water-resistant type as selected by fabricator to comply with requirements.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- B. Installation Adhesive:

## 2.5 FABRICATION

- A. Grade: North American Architectural Woodworking Standards (NAAWS) Custom Grade.
- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:
  - 1. Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times countertop fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as

intended, and check measurements of assemblies against field measurements before disassembling for shipment.

- D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 1. Seal edges of cutouts by saturating with varnish.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

#### 3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  - 1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches (3-mm-in-2400-mm) variation from a straight, level plane.
  - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
  - 3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 23.13



## SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples: For each type of material exposed to view.

#### 1.3 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

#### 1.4 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

### PART 2 - PRODUCTS

#### 2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Avonite Surfaces; a Brand of Aristech Surfaces LLC.
  - b. DuPont; DuPont de Nemours, Inc.
  - c. Swan Surfaces LLC (Swanstone).
  - d. Wilsonart LLC.
  - e. Or equal.
2. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

## 2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:

1. 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch- (19-mm-) thick, solid surface material.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

F. Joints:

1. Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
  - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Make corner holes of largest radius practical.
4. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## 2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- F. Install end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. to prevent snipping.
  - 1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

## SECTION 13 29 13 - SKATEBOARD PARK

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Skateboard Park.

B. Related Requirements:

1. Section 03 30 00 "Cast in Place Concrete" for forming, material quality, mix designs, expansion and control joints, concrete finishing, and curing of Cast in Place Concrete elements within Skateboard Park.
2. Section 03 37 13 "Shotcrete" for forming, material quality, mix designs, expansion and control joints, finishing, and curing of shotcrete elements within Skateboard Park.
3. Section 05 50 00 "Metal Fabrications" for steel tube and plate elements within Skateboard Park.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: See Division 03 and Division 05 Sections for applicable submittal requirements.
- B. Shop Drawings: See Division 03 Sections for applicable submittal requirements.
1. Skateboard Park formwork.
  2. Skateboard Park CIP concrete and shotcrete reinforcing and joint locations.
  3. Skateboard Park steel tube coping and powder coated steel faceplates.
  4. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated Design Submittals: For Skateboard Park, including engineering calculations, and other analysis data to support design, signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Delegated design engineer qualifications.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Skateboard Park Specialty Construction sub-contractor: Minimum of 10 years proven experience in Design and Construction of Skateboard Parks in Southern California.
  - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in California where Project is located and who is experienced in providing engineering services of the type indicated.

#### 1.6 MOCKUPS

- A. Build mockups to set quality standards for materials and execution.
  - 1. Build one full scale mockup of 3 foot high skateboard ramp with coping.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design {Insert product or system}.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

#### 2.2 DESIGN-BUILD SPECIAL CONSTRUCTION SUB-CONTRACTORS

- A. Spohn Ranch Skateparks (Basis of Design).

- B. Or equal.

## 2.3 MATERIALS

- A. Concrete: See Section 03 30 00 "Cast in Place Concrete for formwork, reinforcing steel, concrete materials, mixing, mix designs, finishing and curing.
- B. Shotcrete: See Section 03 37 13 "Shotcrete" for reinforcing steel, shotcrete materials, mixing, mix designs, finishing and curing.
- C. Metal: See Section 05 50 00 "Metal Fabrications for steel tube and powder coated steel plate.
- D. See additional material Specifications on Drawing sht. SK2.0.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, formwork lines and levels, substrate compaction, other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Concrete: See Section 03 30 00 "Cast in Place Concrete."
- B. Shotcrete: See Section 03 37 13 "Shotcrete."
- C. Metal: See Section 05 50 00 "Metal Fabrications."
- D. See additional preparation requirements on Drawing sht. SK2.0.

### 3.3 INSTALLATION

- A. Concrete: See Section 03 30 00 "Cast in Place Concrete."
- B. Shotcrete: See Section 03 37 13 "Shotcrete."
- C. Metal: See Section 05 50 00 "Metal Fabrications."
- D. See additional installation requirements on Drawing sht. SK2.0.



SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

END OF SECTION 13 29 13

## SECTION 13 29 23 – SPLASH PAD

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Splash Pad.

B. Related Requirements:

1. Section 03 30 00 "Cast in Place Concrete" for forming, material quality, mix designs, expansion and control joints, concrete finishing, and curing of concrete within Splash Pad area, underground water containment tank sub-slab, pump room slab on grade, thrust blocks, and other concrete site elements as part of Splash Pad feature.
2. Section 05 50 00 "Metal Fabrications" for steel fabrications as part of Splash Pad feature.
3. Division 22 – Plumbing Sections for plumbing materials and installation requirements of Splash Pad water distribution, chemical treatment and drainage systems.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: See Division 03 and Division 05 Sections for applicable submittal requirements.
- B. Shop Drawings: See Division 03 Sections for applicable submittal requirements.
1. Splash Pad formwork.
  2. Splash Pad CIP concrete reinforcing and joint locations.
  3. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated Design Submittals: For Splash Pad, including engineering calculations, and other analysis data to support design, signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Delegated design engineer qualifications.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Splash Pad Specialty Construction sub-contractor: Minimum of 10 years proven experience in Design and Construction of similar splash pad installations in Southern California.
  - 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in California where Project is located and who is experienced in providing engineering services of the type indicated.

#### 1.6 MOCKUPS

- A. Build mockups to set quality standards for materials and execution.
  - 1. Build one full scale mockup of 8 ft. by 8 ft. concrete pad with minimum of two different types of spray nozzle feature included in design of splash pad. Demonstrate spray nozzle feature for City's representative.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design {Insert product or system}.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

#### 2.2 DESIGN-BUILD SPECIAL CONSTRUCTION SUB-CONTRACTORS

- A. Vortex USA, Inc. (Basis of Design).

- B. Or equal.

## 2.3 MATERIALS

- A. Concrete: See Section 03 30 00 "Cast in Place Concrete for formwork, reinforcing steel, concrete materials, mixing, mix designs, finishing and curing.
- B. Metal: See Section 05 50 00 "Metal Fabrications for galvanized steel bar grating, aluminum diamond plate, galvanized steel angles and plates, channel strut framing, and fasteners.
- C. See Division 22 – Plumbing Sections for piping, fittings, valves, gages, meters, pumps, strainers. See drawings for spray nozzle assemblies and spray zone structures specific to Vortex.
- D. See Drawings for additional material/components required for a complete splash pad installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, formwork lines and levels, substrate compaction, other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Concrete: See Section 03 30 00 "Cast in Place Concrete."
- B. Metal: See Section 05 50 00 "Metal Fabrications."
- C. Division 22 – Plumbing Sections.
- D. See drawings for additional preparation requirements.

### 3.3 INSTALLATION

- A. Concrete: See Section 03 30 00 "Cast in Place Concrete."
- B. Metal: See Section 05 50 00 "Metal Fabrications."
- C. Division 22 – Plumbing Sections.

- D. See drawings for additional installation requirements.

END OF SECTION 13 29 13

## SECTION 13 31 23 - PRE-ENGINEERED FABRIC SHADE STRUCTURES

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. A single, State of California-licensed fabric shade structure contractor shall be responsible for the design, wet-stamped engineering drawings, permitting, fabrication, supply, and erection of the work specified herein, including foundations. The intent of this specification is to have only one shade contractor be responsible for all of the functions listed above.

#### 1.2 SUBMITTALS

##### 1.2.1 With Bid Submittals:

- A. Provide proof of existing reference sites with structures of similar project scope and scale and engineered to the specified CBC requirements.
- B. Provide a minimum of 7 fabric samples to demonstrate fabric color range, and a digital (PDF) or paper document showing a minimum of 9 powder coat color choices. Also, provide a letter of authorization from the fabric manufacturer delineating authorized use of the specified fabric.
- C. Provide proof of all quality assurance items, including;
  - 1. A list of at least 3 reference projects of similar scope in California that have been installed a minimum of 12 years.
  - 2. Proof of General Liability, Professional Liability, and Umbrella insurance, as per Section 1.4B.
  - 3. Proof of current State of California Contractor's License, Class A or Class B.
  - 4. Proof of current City of Los Angeles Approved Fabricator license.
  - 5. Proof of a minimum of \$6,000,000 aggregate bonding capacity.
  - 6. Proof of current IAS certification, as per Section 1.4D.
  - 7. Proof of an Annual Maintenance Inspection Program.
  - 8. Proof of a Corporate Safety and/or Injury & Illness Prevention Program.
  - 9. Proof of current status as an ISNetworld Member Contractor.

### 1.3 QUALITY ASSURANCE

Fabrication and erection are limited to firms with proven experience in the design, fabrication, and erection of fabric shade structures, and such firms shall meet the following minimum requirements. No substitutions shall be allowed for the following:

- A. A single shade structure contractor shall design, engineer, manufacture, and erect the fabric shade structures, including the foundations, and shall provide a dedicated Project Manager throughout the entire Scope of Work related to the shade structure(s).
- B. All bidders shall have at least 15 years' experience in the design, engineering, manufacture, and erection of fabric shade structures, engineered to California Building Code requirements with similar scope, and a successful construction record of in-service performance.
- C. All bidders shall provide proof with bid submittal of a minimum of \$1,000,000 General/Public Liability insurance, \$3,000,000 Professional Liability (PL) insurance, and additional \$5,000,000 Umbrella/Excess Liability insurance.
- D. All bidders shall be a currently licensed contractor in the State of California, and shall provide proof of a minimum aggregate bonding capacity of \$6,000,000 with bid.
- E. Manufacturer shall have a City of Los Angeles Approved Fabricator license and be accredited by the IAS (International Accreditation Service) for Structural Steel Fabrication under CBC specified requirements.
- F. The fabric shade structure contractor shall have a Corporate Quality Control program (manual), which describes their complete quality assurance program.
- G. All bidders must be a current Member Contractor with ISNetworld, which confirms the bidder's strict adherence to Safety, Insurance, Quality, and Regulatory standards.

### 1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for fabric shade structure(s) shown on the drawings in relation to the property survey and existing structures, and verify locations by field measurements prior to erection of the fabric shade structure(s).

### 1.5 WARRANTY

- A. The successful bidder shall provide a 12-month warranty on all labor and materials.

- B. A supplemental warranty from the manufacturer shall be provided for a period of 10 years (pro-rated) on fabric and 10 years on the structural integrity of the steel, from date of substantial completion.
- C. The warranty shall not deprive the City of other rights the City may have under the provisions of the Contract Documents, and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## PART 2 – PRODUCTS

### 2.1 GENERAL

- A. The structures shall consist of one: (1) 26'x16' ' Full Canti Hip with 10'entry height, structural columns shall be a minimum of HSS 8.625x.375; one (1) ~31'x34'4 point hypar sail with 9'/15' entry height, structural columns shall be a minimum of HSS 10.75x.365; two (2) 15'x30' Custom Canti Wing Cable w 10/12 entry height, 3 columns per unit shall be a minimum of HSS 8.0x8.0x.375 structural columns.
- B. The structures shall be designed, engineered and manufactured by Shade Structures, Inc., d/b/a USA SHADE & Fabric Structures, or approved equal and include site-specific line drawings at time of bid. Full scope of work to include installation of structure(s) including project management and foundations all under one shade manufacturer as submitted at time of bid.
- C. Contact: USA SHADE & Fabric Structures  
1085 N. Main Street, Suite C  
Orange, CA 92867  
Phone: 714.427.6981  
Attn: Patti Abrecht  
patti.abrecht@usa-shade.com
- D. To qualify as an approved equal, please submit product documentation, fabric samples, and all quality assurance criteria, as per Section 1.4, at least 10 days prior to bid in order to be considered. No substitutions will be allowed after the deadline. Any approval of alternate manufacturers shall be by addendum prior to the bid date and shall not be allowed without written notification.
- E. The fabric shade structure(s) shall conform to the current adopted version of the California Building Code.
- F. All fabric shade structures are designed and engineered to meet the minimum of 110mph Wind Load, Risk Category II, Exposure C, and Seismic (earthquake) Load based on Seismic Design Category D, Seismic Risk Category II, and a Live Load of 5psf. All fabric shade structures shall be engineered with a zero wind pass-through factor on the fabric. When ASD Steel Design Method is used based on CBC Section 1605.3.1, the load combinations Dead Load + 0.75 Live load + 0.75 Wind Load, and 0.6 Dead Load + Wind Load must be analyzed. NO EXCEPTIONS.



G. Steel:

1. All steel members of the fabric shade structure shall be designed in strict accordance with the requirements of the "American Institute of Steel Construction" (AISC) Specifications and the "American Iron and Steel Institute" (AISI) Specifications for Cold-Formed Members and manufactured in a IAS- (International Accreditation Service) accredited facility for Structural Steel Fabrication under CBC Section 1704.2.5.2.
2. All connections shall have a maximum internal sleeving tolerance of .0625" using high-tensile strength steel sections with a minimum sleeve length of 6".
3. All non-hollow structural steel members shall comply to ASTM A-36. All hollow structural steel members shall be cold-formed, high-strength steel and comply with ASTM A-500, Grade C. All steel plates shall comply with ASTM A-572, Grade 50. All galvanized steel tubing shall be triple-coated for rust protection using an in-line electroplating coat process. All galvanized steel tubing shall be internally coated with zinc and organic coatings to prevent corrosion.

H. Bolts:

1. All structural field connections of the shade structure shall be designed and made with high-strength bolted connections using ASTM A-325, Grade B or SAE J249, Grade 8.
2. Where applicable, all stainless steel bolts shall comply with ASTM F-593, Alloy Group 1 or 2. All bolt fittings shall include rubber washers for water-tight seal at the joints. All nuts shall comply with ASTM F-594, Alloy Group 1 or 2.

I. Welding:

1. All shop-welded connections of the fabric shade structure shall be designed and performed in strict accordance with the requirements of the "American Welding Society" (AWS) Specifications. Structural welds shall be made in compliance with the requirements of the "pre-qualified" welded joints, where applicable and by certified welders. No onsite or field welding shall be permitted.
2. All full penetration welds shall be continuously inspected by an independent inspection agency and shall be tested to the requirement of specified CBC requirements.

J. Powder Coating:

1. Galvanized steel tubing preparation prior to powder coating shall be executed in accordance with solvent cleaning SSPC-SP1. Solvents such as water,

mineral spirits, xylol, and toluol, which are to be used to remove foreign matter from the surface. A mechanical method prior to solvent cleaning, and prior to surface preparation, shall be executed according to Power Tool Cleaning SSPC-SP3, utilizing wire brushes, abrasive wheels, needle gun, etc.

2. Carbon structural steel tubing preparation prior to powder coating shall be executed in accordance with commercial blast cleaning SSPC-SP6 or NACE #3. A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, mill scale, rust, coating, oxides, corrosion, and other foreign material.
3. Powder coating shall be sufficiently applied (minimum 3 mils thickness) and cured at the recommended temperature to provide proper adhesion and stability to meet salt spray and adhesion tests, as defined by the American Society of Testing Materials.
4. Raw powder used in the powder coat process shall have the following characteristics:
  - a. Specific gravity: 1.68 +/- 0.05
  - b. Theoretical coverage: 114 +/- 4ft<sup>2</sup>/mil
  - c. Mass loss during cure: <1%
  - d. Maximum storage temperature: 80°F
  - e. Interpon® 800 is a high-durability TGIC powder coating designed for exterior exposure. Tested against the most severe specifications, Interpon® 800 gives significantly improved gloss retention and resistance to color change.
5. When the fabric shade structure(s) will be located within 15 miles of the ocean or standing body of water, rust protection undercoat primer will be required on all structures. Sherwin-Williams® POWDURA® epoxy powder coating Z.R Primer shall be applied in accordance with the manufacturer's specifications. Primer should be fused only and then top coated with the selected powder coat to ensure proper inter-coat adhesion.
  - a. The primer's attributes shall be:
    - a. Specific gravity (g/ml): 2.37
    - b. Coverage at 1.0 mil (ft<sup>2</sup>/lb): 81.6
    - c. Adhesion: ASTM D-3359 5B
    - d. Flexibility: ASTM D-552 Pass 1/8"
    - e. Pencil hardness: ASTM D-3363 H-2H
    - f. Impact resistance (in.lb): ASTM D-2794 Dir & Rev, 120 in-lbs
    - g. Salt spray resistance: ASTM B-117 2000 hours
    - h. Humidity resistance: ASTM D-4585 2000 hours
    - i. 60° Gloss: ASTM D-523 50 ~ 70
    - j. Cure schedule (metal temp): 10min @ 200°C (390°F)
    - 25min @ 135°C (275°F)

k. Film thickness tange (mils): 2.0 ~ 3.0

K. Tension Cable: Steel cable is determined based on calculated engineering loads.

1. For light and medium loads, 0.25" (nominal) galvanized 7x19 strand cable shall be used.
2. For heavy loads, and depending on structural size, either 0.375" (nominal) or 0.5" (nominal) galvanized 7x19 strand cable shall be used.

L. Fabric Roof Systems:

1. UV Shade Fabric:

- a. Colourshade® FR UV shade fabric is made of a UV-stabilized, high-density polyethylene (HDPE), as manufactured by Multiknit® (Pty) Ltd. HDPE mesh shall be a heat-stentered, three bar Rachel-knitted, lockstitch fabric with one monofilament and two tape yarns to ensure that the material will not unravel if cut. Raw fabric rolls shall be 9.8425 feet wide.
- b. Fabric Properties:
  - ~ Life Expectancy: minimum 8 years with continuous exposure to the sun
  - ~ Fading: minimum fading after 5 years (3 years for Red)
  - ~ Fabric Mass: 5.31 oz/yd<sup>2</sup> ~ 5.6 oz/yd<sup>2</sup> (180gsm ~ 190gsm)
  - ~ Fabric Width: 9.8425 feet (3m)
  - ~ Roll Length: 164.04 feet (50m)
  - ~ Roll Dimensions: 62.99 inches x 16.5354 inches (160cm x 42cm)
  - ~ Roll Weight +/- 66 lbs (+/- 30kg)
  - ~ Minimum Temp: -13°F (-25°C)
  - ~ Maximum Temp: +176°F (80°C)
- c. Fabric shall meet the following flame spread and fire propagation tests:
  - 1) ASTM E-84
  - 2) NFPA 701 Test Method 2
  - 3) California's Office of the State Fire Marshal, Registered Flame Resistant Product

2. Stitching & Thread:

- a. All sewing seams are to be double-stitched.
- b. The thread shall be GORE® TENARA® mildew-resistant sewing thread, manufactured from 100% expanded PTFE (Teflon™). Thread shall meet or exceed the following:
  - 1) Flexible temperature range
  - 2) Very low shrinkage factor
  - 3) Extremely high strength, durable in outdoor climates
  - 4) Resists flex and abrasion of fabric
  - 5) Unaffected by cleaning agents, acid rain, mildew, salt water, and is unaffected by most industrial pollutants

- 6) Treated for prolonged exposure to the sun
- 7) Rot resistant

3. Shade and UV Factors:

- a. Shade protection and UV screen protection factors shall be as follows:

<u>Color</u>	<u>UV Block %</u>	<u>Shade %</u>
Pacific Blue	85%	80%~86%
Rain Forest	85%	79%~86%
Green		
Red	86%	80%~83%
Silver	81%	80%~85%
Desert Sand	92%	80%~84%
Terracotta	82%	80%~83%
Yellow	89%	80%~82%

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. The installation of fabric shade structures shall be performed by manufacturer or manufacturer-approved contractor, which shall be bonded and holding a current contractor's license with the State of California's Contractors State License Board. All installation personnel must have experience in the erection of tensioned fabric structures.
- B. The installation shall comply with the manufacturer's instructions for assembly, installation and erection, per approved drawings.
- C. Concrete:
  - 1. Unless noted otherwise for footings and piers by the Project Engineer, the concrete specification for footings and/or piers shall meet a minimum 3,000psi at 28-day strength.
  - 2. Concrete work shall be executed in accordance with the latest edition of American Concrete Building Code ACI 318-14.
  - 3. Concrete specifications shall comply in accordance with the Section 03300 Cast-in-Place Concrete, detailed as per plans, and shall be as follows:
    - a. 28 Days Strength  $F'_c = 3000$  psi
    - b. Aggregate: HR
    - c. Slump: 3 ~ 5 inch
    - d. Portland Cement shall conform to C-150
    - e. Aggregate shall conform to ASTM C-33
  - 4. All reinforcement shall conform to ASTM A-615 grade 60.

5. Reinforcing steel shall be detailed, fabricated, and placed in accordance with the latest ACI Detailing Manual and Manual of Standard Practice.
6. Whenever daily ambient temperatures are below 80 degrees Fahrenheit, the contractor may have mix accelerators and hot water added at the batch plant (See Table 1).
7. The contractor shall not pour any concrete when the daily ambient temperature is to be below 55 degrees Fahrenheit.

TABLE 1

Temperature Range	% Accelerator	Type Accelerator
75~80 degrees F	1%	High Early (non calcium)
70~75 degrees F	2%	High Early (non calcium)
Below 70 degrees F	3%	High Early (non calcium)

D. Foundations:

1. All anchor bolts set in new concrete shall comply with ASTM F-1554 Grade 55 (Galvanized).
2. All anchor bolts shall be Hot-Dip Galvanized.
3. Footings and full rebar cages shall be drilled, set, and poured as per manufacturer's specifications. The shade structures are to have a recessed base plated column to manufacture supplied anchor bolts set in foundation that is a minimum 30" diameter x 8' deep with full rebar cage, as per final approved manufacturer's engineered specifications and drawings.

END OF SECTION 13 31 23

## SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Plumbing demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

#### 1.02 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
  2. CPVC: Chlorinated polyvinyl chloride plastic.
  3. PE: Polyethylene plastic.
  4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

### 1.03 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

### 1.04 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Piping penetration through fire-rated construction assemblies, including accessory components; sleeves, sealants, packing materials and methods, and installation shall meet the requirements of the CBC, and shall be California State Fire Marshal approved. Firestopping details shall bear the UL label, indicate F-rating, T-rating, and shall meet the requirements of the California Building Code.
- E. Groove-less clamps, cut groove pipe and fittings, reducing couplings, mechanical tees or saddle fittings are not acceptable.

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.06 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Doors and Windows. Coordinate to avoid access panels at hard lid ceiling if possible. Access panel shall be located in accessible area for maintenance convenience and safety and limit disturbance to the public.
- D. Coordinate with other sections of the specifications for the applicability of materials specified in this section. Not every product or material listed may be used.
- E. Coordinate requirements of this section with actual work to be performed. This section is general in scope for basic materials and methods, all of which may not actually apply to this project.
- F. There shall be no contact between the piping for the building and other systems or each other, except through an isolator. If contact is unavoidable, then the contractor shall use closed cell foam (i.e., Armaflex Ap 1/2-inch thick and 3 inches long) at the point of connection.

## PART 2 - PRODUCTS

### 2.01 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.02 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, **1/8-inch** maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.



2. AWWA C110, rubber, flat face, **1/8 inch thick**, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: Bolts shall be United States Customary System bolts and nuts (e.g.,  $\frac{3}{4}$ "). Metric bolts and nuts shall not be used. Bolts and nuts shall be SAE Grade 5 hot-dip galvanized steel or stainless steel with heavy hex nuts.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, BCup3 or BCUp4, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  1. ABS Piping: ASTM D 2235.
  2. CPVC Piping: ASTM F 493.
  3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.03 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
    - g. Or equal.
  2. Underground Piping **NPS 1-1/2** and Smaller: Manufactured fitting or coupling.
  3. Underground Piping **NPS 2** and Larger: AWWA C219, metal sleeve-type coupling.
  4. Aboveground Pressure Piping: Pipe fitting.

- B. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

- a. Eslon Thermoplastics.
- b. Or equal.

- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

- a. Thompson Plastics, Inc.
- b. Or equal.

- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

- a. NIBCO INC.
- b. NIBCO, Inc.; Chemtrol Div.
- c. Or equal.

- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

- a. Cascade Waterworks Mfg. Co.
- b. Fernco, Inc.
- c. Mission Rubber Company.
- d. Plastic Oddities, Inc.
- e. Or equal.

## 2.04 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Shall not be used. Provide 6" long brass nipple with brass unions. Or brass union and bronze ball valve on ends of nipple.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
    - e. Or equal.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Or equal.
  2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
    - c. Or equal.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.
    - e. Or equal.

## 2.05 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Thunderline Modular Seals: Link-seal
    - f. Or equal.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.06 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.07 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.08 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: **5000-psi**, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
  - 2. Existing Piping: Use the following:
    - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
    - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.

- g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Mounting hardware, including nuts, bolts and washers for outdoor applications and below grade applications must be of stainless-steel materials.
- N. Sleeves are not required for core-drilled holes, except in L Occupancies and other locations, where spill control is required.
- O. Permanent sleeves are not required for holes formed by removable PE sleeves.
- P. Install sleeves for pipes passing through interior concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide **1/4-inch** annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than **NPS 6**, mechanical rooms and wet area applications, where spill containment is required.
    - b. Steel Sheet Sleeves: For pipes **NPS 6** and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to **2 inches** above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
  - 5. Sleeve application and installation shall comply with CBC requirements and UL approved Firestopping Details
  - 6. Coordinate requirements of sound-proofing caulk, as determined by the Sound and Vibration Consultant's recommendations.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than **6 inches** in diameter.

2. Install cast-iron "wall pipes" for sleeves **6 inches** and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section 07 84 00 "Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- V. Install valves in readily accessible locations, avoiding hard-lid ceilings where possible. Provide access panels for valve access complying with Division 08, and coordinate access panel locations with other disciplines.

### 3.02 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Oxyacetylene torch welding and cutting of structural steel or bolt holes shall not be permissible.



- F. Install main and branch piping using specified fittings, "T-drill", "welded nozzles", or "Side-Tap" or similar fitting substitution style connections are not acceptable.
- G. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- H. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- I. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- J. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- K. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- N. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

- O. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.03 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install shut-off valves at final connection to each piece of equipment.
  - 2. Install unions, in piping **NPS 2** and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 3. Install flanges, in piping **NPS 2-1/2** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 4. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 5. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.05 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "High-Performance Coatings."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.06 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than **4 inches** larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch** centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use **3000-psi**, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

### 3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.
- D. Outdoor Applications: Outdoor support assemblies and accessories shall be of "stainless steel material", or "hot-dip galvanized carbon steel with high-performance coatings", as noted below:
  1. Stainless steel: Mounting hardware such as bolts, nuts, washers, straps, brackets, fastening hardware etc., shall be stainless steel.
  2. Coated galvanized steel: Carbon steel support assemblies, including all metal fabrications for use outdoors shall comply with each paragraph listed below:
    - a. Assemblies must be shop-fabricated and pre-assembled for one-piece hot-dip galvanized coating process
    - b. After hot-dip galvanized coating is applied, a high-performance exterior coating system shall be applied. Provide High-Performance Exterior Coating Systems conforming to Division 09 Finishes, meeting all performance requirements, including salt spray test performance.
    - c. Touch-up and repair per manufacturer's recommendations after field installation.
- E. Rooftop Applications: Rooftop support assemblies and accessories shall be fabricated for outdoor applications as noted above and shall be designed per SMACNA design requirements.
  1. SMACNA Clearances: Pipes, pipe racks, and equipment shall be installed high enough above roofing surfaces to allow roofing access for maintenance and repair. Install piping and equipment at a minimum height as shown in Table 4-1 of SMACNA Architectural Sheet Metal Manual – 5th Edition.

2. SMACNA Support Systems: Piping systems and equipment supports, unless otherwise shown, use round column supports to tie-in to structure with lead jacks for built-up roofs, and single-ply preformed jacks for single-ply roofs, lead flashing, and lead umbrellas with stainless steel draw band per Figure 4-16A, or Figure 4-16B, of SMACNA Architectural Sheet Metal Manual – 5th Edition.

### 3.08 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

## SECTION 22 05 14 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

#### 1.03 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

### PART 2 - PRODUCTS

#### 2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

#### 2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

#### 2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T, Totally Enclosed Fan Cooled (TEFC).

## 2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 2.05 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
  2. Split phase.
  3. Capacitor start, inductor run.
  4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.01 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

#### 2.02 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
  - 1. Metraflex Company (The).
- C. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.03 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.01 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 2-inch (50-mm) annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

### 3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

END

OF

SECTION

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Filled-system thermometers.
  - 3. Liquid-in-glass thermometers.
  - 4. Light-activated thermometers.
  - 5. Thermowells.
  - 6. Dial-type pressure gages.
  - 7. Gage attachments.
  - 8. Test plugs.
  - 9. Test-plug kits.
  - 10. Sight flow indicators.
- B. Related Sections:
  - 1. Section 22 11 16 "Domestic Water Piping" for water meters inside the building.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.01 BIMETALLIC-ACTUATED THERMOMETERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Ashcroft Inc.
  - 2. Ernst Flow Industries.

3. Marsh Bellofram.
  4. Miljoco Corporation.
  5. Nanmac Corporation.
  6. Noshok.
  7. Palmer Wahl Instrumentation Group.
  8. REOTEMP Instrument Corporation.
  9. Tel-Tru Manufacturing Company.
  10. Trerice, H. O. Co.
  11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  12. Weiss Instruments, Inc.
  13. WIKA Instrument Corporation - USA.
  14. Winters Instruments - U.S.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus, or minus 1 percent of scale range.

## 2.02 FILLED-SYSTEM THERMOMETERS

- A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  2. Ashcroft Inc.
  3. Marsh Bellofram.
  4. Miljoco Corporation.
  5. Palmer Wahl Instrumentation Group.
  6. REOTEMP Instrument Corporation.
  7. Trerice, H. O. Co.
  8. Weiss Instruments, Inc.

9. Standard: ASME B40.200.
  10. Case: Sealed type, cast aluminum or drawn steel 4-1/2-inch (114-mm) nominal diameter.
  11. Element: Bourdon tube or other type of pressure element.
  12. Movement: Mechanical, dampening type,] with link to pressure element and connection to pointer.
  13. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  14. Pointer: Dark-colored metal.
  15. Window: Glass.
  16. Ring: Metal.
  17. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
  18. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  19. Accuracy: Plus, or minus 1 percent of scale range.
- B. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
- a. Ashcroft Inc.
  - b. Miljoco Corporation.
  - c. REOTEMP Instrument Corporation.
2. Standard: ASME B40.200.
  3. Case: Sealed type, plastic; 4-1/2-inch (114-mm) nominal diameter.
  4. Element: Bourdon tube or other type of pressure element.
  5. Movement: Mechanical, with link to pressure element and connection to pointer.
  6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  7. Pointer: Dark-colored metal.
  8. Window: Glass.
  9. Ring: Metal.
  10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
  11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  12. Accuracy: Plus, or minus 1 percent of scale range.
- D. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. AMETEK, Inc.; U.S. Gauge.
    - b. Ashcroft Inc.
    - c. Marsh Bellofram.

- d. Miljoco Corporation.
  - e. Palmer Wahl Instrumentation Group.
  - f. REOTEMP Instrument Corporation.
  - g. Trerice, H. O. Co.
  - h. Weiss Instruments, Inc.
  - i. WIKA Instrument Corporation - USA.
- E. Standard: ASME B40.200.
- 1. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter with back flange and holes for panel mounting.
  - 2. Element: Bourdon tube or other type of pressure element.
  - 3. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 4. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  - 5. Pointer: Dark-colored metal.
  - 6. Window: Glass.
  - 7. Ring: Metal.
  - 8. Connector Type(s): Union joint, back; with ASME B1.1 screw threads.
  - 9. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 10. Accuracy: Plus, or minus 1 percent of scale range.
- F. Remote-Mounted, Plastic-Case, Vapor-Actuated Thermometers:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. AMETEK, Inc.; U.S. Gauge.
    - b. Ashcroft Inc.
    - c. Miljoco Corporation.
    - d. REOTEMP Instrument Corporation.
    - e. Trerice, H. O. Co.
  - 2. Standard: ASME B40.200.
  - 3. Case: Sealed type, plastic; 4-1/2-inch (114-mm) nominal diameter with back flange and holes for panel mounting.
  - 4. Element: Bourdon tube or other type of pressure element.
  - 5. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  - 7. Pointer: Dark-colored metal.
  - 8. Window: Glass.
  - 9. Ring: Metal.
  - 10. Connector Type(s): Union joint, threaded, back; with ASME B1.1 screw threads.
  - 11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 12. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.



## 2.03 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Terice, H. O. Co.
  2. Standard: ASME B40.200.
  3. Case: Cast aluminum; 6-inch (152-mm) nominal size.
  4. Case Form: Back angle unless otherwise indicated.
  5. Tube: Glass with magnifying lens and blue or red organic liquid.
  6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  7. Window: Glass or plastic.
  8. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  9. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
  10. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Flo Fab Inc.
    - b. Miljoco Corporation.
    - c. Tel-Tru Manufacturing Company.
    - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - e. Weiss Instruments, Inc.
    - f. WIKA Instrument Corporation - USA.
  2. Standard: ASME B40.200.
  3. Case: Plastic; 6-inch (152-mm) nominal size.
  4. Case Form: Back angle unless otherwise indicated.
  5. Tube: Glass with magnifying lens and blue or red organic liquid.
  6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F.
  7. Window: Glass or plastic.
  8. Stem: Aluminum or brass and of length to suit installation.
  9. Design for Thermowell Installation: Bare stem.
  10. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.
  11. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- C. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Flo Fab Inc.
    - b. Miljoco Corporation.
    - c. Palmer Wahl Instrumentation Group.

- d. Tel-Tru Manufacturing Company.
  - e. Trerice, H. O. Co.
  - f. Weiss Instruments, Inc.
  - g. Winters Instruments - U.S.
  3. Standard: ASME B40.200.
  4. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
  5. Case Form: Adjustable angle unless otherwise indicated.
  6. Tube: Glass with magnifying lens and blue or red organic liquid.
  7. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in [deg F.
  8. Window: Glass.
  9. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  10. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
  11. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- D. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Ernst Flow Industries.
    - b. Marsh Bellofram.
    - c. Miljoco Corporation.
    - d. Palmer Wahl Instrumentation Group.
    - e. REOTEMP Instrument Corporation.
    - f. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - g. Weiss Instruments, Inc.
    - h. WIKA Instrument Corporation - USA.
  3. Standard: ASME B40.200.
  4. Case: Plastic; 7-inch (178-mm) nominal size unless otherwise indicated.
  5. Case Form: Adjustable angle unless otherwise indicated.
  6. Tube: Glass with magnifying lens and blue or red organic liquid.
  7. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
  8. Window: Glass.
  9. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  10. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
  11. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.04 LIGHT-ACTIVATED THERMOMETERS

- A. Direct-Mounted, Light-Activated Thermometers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Flo Fab Inc.

- b. REOTEMP Instrument Corporation.
    - c. Trerice, H. O. Co.
    - d. Weiss Instruments, Inc.
    - e. WIKA Instrument Corporation - USA.
  2. Case: Plastic; 7-inch (178-mm) nominal size unless otherwise indicated.
  3. Scale(s): Deg F and deg C.
  4. Case Form: Adjustable angle.
  5. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
  6. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  7. Display: Digital.
  8. Accuracy: Plus, or minus 2 deg F (1 deg C).
- B. Remote-Mounted, Light-Activated Thermometers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Miljoco Corporation.
    - b. Weiss Instruments, Inc.
    - c. Winters Instruments - U.S.
  2. Case: Plastic, for wall mounting.
  3. Scale(s): Deg F and deg C.
  4. Sensor: Bulb and thermister wire.
    - a. Design for Thermowell Installation: Bare stem.
  5. Display: Digital.
  6. Accuracy: Plus, or minus 2 deg F (1 deg C).

## 2.05 THERMOWELLS

- A. Thermowells:
1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  3. Material for Use with Copper Tubing: CNR.
  4. Material for Use with Steel Piping: CRES.
  5. Type: Stepped shank unless straight or tapered shank is indicated.
  6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
  7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
  8. Bore: Diameter required to match thermometer bulb or stem.
  9. Insertion Length: Length required to match thermometer bulb or stem.
  10. Lagging Extension: Include on thermowells for insulated piping and tubing.
  11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.06 PRESSURE GAGES

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Ernst Flow Industries.
  - d. Flo Fab Inc.
  - e. Marsh Bellofram.
  - f. Miljoco Corporation.
  - g. Noshok.
  - h. Palmer Wahl Instrumentation Group.
  - i. REOTEMP Instrument Corporation.
  - j. Tel-Tru Manufacturing Company.
  - k. Trerice, H. O. Co.
  - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - m. Weiss Instruments, Inc.
  - n. WIKA Instrument Corporation - USA.
  - o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

### B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Flo Fab Inc.
  - d. Marsh Bellofram.
  - e. Miljoco Corporation.
  - f. Noshok.
  - g. Palmer Wahl Instrumentation Group.
  - h. REOTEMP Instrument Corporation.
  - i. Tel-Tru Manufacturing Company.
  - j. Trerice, H. O. Co.
  - k. Weiss Instruments, Inc.
  - l. WIKA Instrument Corporation - USA.

- m. Winters Instruments - U.S.
  - 2. Standard: ASME B40.100.
  - 3. Case: Sealed type; plastic; 4-1/2-inch (114-mm) nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass.
  - 10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- C. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. AMETEK, Inc.; U.S. Gauge.
    - b. Ashcroft Inc.
    - c. Ernst Flow Industries.
    - d. Flo Fab Inc.
    - e. Marsh Bellofram.
    - f. Miljoco Corporation.
    - g. Noshok.
    - h. Palmer Wahl Instrumentation Group.
    - i. REOTEMP Instrument Corporation.
    - j. Tel-Tru Manufacturing Company.
    - k. Trerice, H. O. Co.
    - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - m. Weiss Instruments, Inc.
    - n. WIKA Instrument Corporation - USA.
    - o. Winters Instruments - U.S.
  - 2. Standard: ASME B40.100.
  - 3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter with back flange and holes for panel mounting.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass.
  - 10. Ring: Metal.
  - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.07 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

## 2.08 TEST PLUGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Flow Design, Inc.
  - 2. Miljoco Corporation.
  - 3. National Meter, Inc.
  - 4. Peterson Equipment Co., Inc.
  - 5. Sisco Manufacturing Company, Inc.
  - 6. Trerice, H. O. Co.
  - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 8. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 (DN 8), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa).
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

## 2.09 TEST-PLUG KITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Flow Design, Inc.
  - 2. Miljoco Corporation.
  - 3. National Meter, Inc.
  - 4. Peterson Equipment Co., Inc.
  - 5. Sisco Manufacturing Company, Inc.
  - 6. Trerice, H. O. Co.
  - 7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 8. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
- F. Carrying Case: Metal or plastic, with formed instrument padding.

## 2.10 SIGHT FLOW INDICATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Archon Industries, Inc.
  - 2. Dwyer Instruments, Inc.
  - 3. Emerson Process Management; Brooks Instrument.
  - 4. Ernst Co., John C., Inc.
  - 5. Ernst Flow Industries.
  - 6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
  - 7. OPW Engineered Systems, a Dover company.
  - 8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.
- B. Description: Piping inline-installation device for visual verification of flow.
- C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- D. Minimum Pressure Rating: 125 psig (860 kPa).
- E. Minimum Temperature Rating: 200 deg F (93 deg C).
- F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
- G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
  - 2. Inlets and outlets of each domestic water heat exchanger.
  - 3. Inlet and outlet of each domestic hot-water storage tank.
  - 4. Inlet and outlet of each remote domestic water chiller.
- L. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each pressure-reducing valve.
  - 3. Suction and discharge of each domestic water pump.

### 3.02 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.03 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

### 3.04 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Direct-mounted, metal-case, vapor-actuated type.
  - 3. Compact Industrial-style, liquid-in-glass type.
  - 4. Direct-mounted, light-activated type.



5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:
  1. Liquid-filled Sealed, bimetallic-actuated type.
  2. Direct-mounted, metal-case, vapor-actuated type.
  3. Compact Industrial-style, liquid-in-glass type.
  4. Direct-mounted, light-activated type.
  5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:
  1. Liquid-filled Sealed, bimetallic-actuated type.
  2. Direct-mounted, metal-case, vapor-actuated type.
  3. Compact-style, liquid-in-glass type.
  4. Direct-mounted, light-activated type.
  5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- D. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:
  1. Liquid-filled, bimetallic-actuated type.
  2. Direct-mounted, metal-case, vapor-actuated type.
  3. Compact-style, liquid-in-glass type.
  4. Direct-mounted, light-activated type.
  5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.
- E. Thermometer stems shall be of length to match thermowell insertion length.

### 3.05 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).
- B. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).
- C. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F (0 to plus 115 deg C).
- D. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).
- E. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F (0 to 150 deg C).
- F. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C).

G. Scale Range for Domestic Cooled-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).

H. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).

### 3.06 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be [ one of] the following:

1. Liquid-filled, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

### 3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi (0 to 600 kPa).

B. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).

C. Scale Range for Water Service Piping: 0 to 200 psi (0 to 1400 kPa).

D. Scale Range for Domestic Water Piping: 0 to 100 psi (0 to 600 kPa).

E. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

F. Scale Range for Domestic Water Piping: 0 to 200 psi (0 to 1400 kPa).

G. Scale Range for Domestic Water Piping: 0 to 300 psi (0 to 2500 kPa).

END OF SECTION

SAMARITAN'S PURSE PARK  
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SAMARITAN'S PURSE PARK  
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## SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Iron, single-flange butterfly valves.
  - 3. Bronze swing check valves.
  - 4. Iron swing check valves.
  - 5. Bronze gate valves.
  - 6. Iron gate valves.
  - 7. Bronze globe valves.
  - 8. Iron globe valves.
- B. Related Sections:
  - 1. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
  - 2. Section 22 11 16 "Domestic Water Piping" for valves applicable only to this piping.
  - 3. Section 22 13 19 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
  - 4. Section 22 14 23 "Storm Drainage Piping Specialties" for valves applicable only to this piping.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated.

#### 1.03 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

### PART 2 - PRODUCTS

#### 2.01 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.

- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.
  - 4.
  - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Solder Joint: With sockets according to ASME B16.18.
  - 3. Threaded: With threads according to ASME B1.20.1.

## 2.02 BRONZE BALL VALVES

- A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 400 psig (2760 kPa).
    - c. Body Design: One piece.
    - d. Body Material: Bronze.
    - e. Ends: Threaded.
    - f. Seats: PTFE or TFE.
    - g. Stem: Bronze.
    - h. Ball: Chrome-plated brass.
    - i. Port: Reduced.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.

- e. Red-White Valve Corporation.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig (1035 kPa).
    - c. CWP Rating: 600 psig (4140 kPa).
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.
    - j. Port: Full.
- C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig (1035 kPa).
    - c. CWP Rating: 600 psig (4140 kPa).
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded.
    - g. Seats: PTFE or TFE.
    - h. Stem: Bronze.
    - i. Ball: Chrome-plated brass.
    - j. Port: Regular.

## 2.03 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. Red-White Valve Corporation.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-67, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).

- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
  - e. Seat: EPDM.
  - f. Stem: One- or two-piece stainless steel.
  - g. Disc: Aluminum bronze.
- B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. Red-White Valve Corporation.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-67, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    - e. Seat: NBR.
    - f. Stem: One- or two-piece stainless steel.
    - g. Disc: Aluminum bronze.
- C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. Mueller Steam Specialty; a division of SPX Corporation.
    - e. NIBCO INC.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-67, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    - e. Seat: EPDM.
    - f. Stem: One- or two-piece stainless steel.
    - g. Disc: Nickel-plated or -coated ductile iron.
- D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



- a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Hammond Valve.
  - c. Milwaukee Valve Company.
  - d. Mueller Steam Specialty; a division of SPX Corporation.
  - e. NIBCO INC.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
- a. Standard: MSS SP-67, Type I.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
  - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
  - e. Seat: NBR.
  - f. Stem: One- or two-piece stainless steel.
  - g. Disc: coated ductile iron.

## 2.04 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.
- B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: PTFE or TFE.

## 2.05 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged.
    - f. Trim: Bronze.
    - g. Gasket: Asbestos free.
- B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged.
    - f. Trim: Composition.
    - g. Seat Ring: Bronze.
    - h. Disc Holder: Bronze.
    - i. Disc: PTFE or TFE.
    - j. Gasket: Asbestos free.

## 2.06 BRONZE GATE VALVES

- A. Class 125, NRS Bronze Gate Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron.
- B. Class 125, RS Bronze Gate Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded or solder joint.
    - e. Stem: Bronze.
    - f. Disc: Solid wedge; bronze.
    - g. Packing: Asbestos free.
    - h. Handwheel: Malleable iron.

## 2.07 IRON GATE VALVES

- A. Class 125, NRS, Iron Gate Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Description:
    - a. Standard: MSS SP-70, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - d. Ends: Flanged.
    - e. Trim: Bronze.
    - f. Disc: Solid wedge.
    - g. Packing and Gasket: Asbestos free.

## 2.08 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Description:
    - a. Standard: MSS SP-80, Type 1.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded or solder joint.
    - e. Stem and Disc: Bronze.
    - f. Packing: Asbestos free.
    - g. Handwheel: Malleable iron.
- B. Class 125, Bronze Globe Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.
    - b. Red-White Valve Corporation.
  2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded or solder joint.
    - e. Stem: Bronze.
    - f. Disc: PTFE or TFE.
    - g. Packing: Asbestos free.
    - h. Handwheel: Malleable iron.

## 2.09 IRON GLOBE VALVES

- A. Class 125, Iron Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  2. Description:
    - a. Standard: MSS SP-85, Type I.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - d. Ends: Flanged.
    - e. Trim: Bronze.
    - f. Packing and Gasket: Asbestos free.

## PART 3 - EXECUTION

### 3.01 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

### 3.02 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, butterfly, or gate valves.
  - 2. Throttling Service: ball or butterfly valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

### 3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Bronze Angle Valves: Class 125, nonmetallic disc.
  - 3. Ball Valves: Two-piece, full port, bronze with bronze trim.
  - 4. Bronze Swing Check Valves: Class 125, disc.
  - 5. Bronze Gate Valves: Class 125.
  - 6. Bronze Globe Valves: Class 125, nonmetallic disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, seat, ductile-iron disc.
3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever, and weight.
5. Iron Gate Valves: Class 125.
6. Iron Globe Valves: Class 125.

END

OF

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## SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Pipe positioning systems.
  - 6. Equipment supports.

#### 1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated.
  - 1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Welding certificates.



## 1.05 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

## PART 2 - PRODUCTS

### 2.01 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

### 2.02 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### 2.03 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 2.04 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.05 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.06 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## PART 3 - EXECUTION

### 3.01 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.02 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods.

### 3.05 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.06 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel corrosion-resistant attachments for hostile environment applications.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  - 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  - 3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SAMARITAN'S PURSE PARK  
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RENOVATIONS  
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## SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Isolation mounts.
  - 2. Elastomeric hangers.
  - 3. Pipe riser resilient supports.
  - 4. Resilient pipe guides.
  - 5. Restraining braces and cables.

#### 1.03 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.
- D. DSA: Division of the State Architect.
- E. CBC: California Building Code.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Design Spectral Response Acceleration at Short Periods (0.2 Second):
  - 2. Design Spectral Response Acceleration at 1-Second Period.
- B. Waste, Vent and Storm Drain Piping Vibration Isolation: At waste piping, all pipes shall be isolated from the structure using a minimum of 1/4-inch material (Hubbard Holdrite Felt 100). Neoprene isolators equal to Hubbard Holdrite 278 shall be used below clamps.
- C. Supply Piping Vibration Isolation: All supply piping shall be acoustically vibration isolated from the structure using Hubbard Holdrite Silencer Series. If vertical support is required, neoprene pads shall be used at clamp locations. They shall be Hubbard Holdrite Silencer 278 or equal.

D. Equipment

1. All equipment and piping shall be isolated from the structure.
2. Pumps shall be isolated with a spring having 1-inch minimum static deflection and equal to Mason Industries.
3. If pipes are 3 inches or larger in diameter, they shall be isolated with neoprene hangers equal to mason Industries type HD having 0.3 inches of static deflection.

1.05 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
  - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES an agency acceptable to authorities having jurisdiction.
  - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic-Restraint Details:
  - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
  - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

## 1.06 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. Qualification Data: For professional engineer.
- C. Welding certificates.
- D. Field quality-control test reports.

## 1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

## 1.08 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

## PART 2 - PRODUCTS

### 2.01 SEISMIC-RESTRAINT DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2. Hilti, Inc.
  - 3. Kinetics Noise Control.

4. Mason Industries.
  5. TOLCO Incorporated; a brand of NIBCO INC.
  6. Unistrut; Tyco International, Ltd
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- I. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## 2.02 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.

2. All hardware shall be galvanized. Hot dip galvanized metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

### 3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 22 11 16 "Domestic Water Piping" for piping flexible connections.

### 3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

### 3.05 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of sprint isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

## SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

#### 1.02 ACTION SUBMITTAL

- A. Product Data: For each type of product indicated.

### PART 2 - PRODUCTS

#### 2.01 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: Brass, 0.032-inch (0.8-mm) Stainless steel, 0.025-inch (0.64-mm) minimum thickness and having predrilled or stamped holes for attachment hardware.
  2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  4. Fasteners: Stainless-steel rivets or self-tapping screws.
  5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
  2. Letter Color: Black Blue Red White Yellow.
  3. Background Color: Black Blue Red White Yellow.
  4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.

- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.02 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black Blue Red White Yellow.
- C. Background Color: Black Blue Red White Yellow.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.03 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.



- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, and as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1-1/2 inches (38 mm) high.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.02 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.03 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Finishes.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
1. Domestic Water Piping:
    - a. Background Color: Black Blue Red White Yellow.
    - b. Letter Color: Black Blue Red White Yellow.
  2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Black Blue Red White Yellow.
    - b. Letter Color: Black Blue Red White Yellow.

END OF SECTION

SAMARITAN'S PURSE PARK  
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PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 22 07 19 - PLUMBING PIPING INSULATION

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic hot-water piping.
  - 2. Domestic recirculating hot-water piping.
  - 3. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Section 22 07 16 "Plumbing Equipment Insulation."

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.

#### 1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.04 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## PART 2 - PRODUCTS

### 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armacell LLC; Tubolit.
    - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

### 2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

### 2.03 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
  - 1. Products: Subject to compliance with requirements, provide the following:

- a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.04 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.05 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. McGuire Manufacturing.
    - b. Plumberex.
    - c. Truebro; a brand of IPS Corporation.
    - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
  2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Truebro; a brand of IPS Corporation.
  - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.03 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

### 3.04 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:



1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

### 3.05 INSTALLATION OF POLYOLEFIN INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.06 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.07 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.08 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  1. Drainage piping located in crawl spaces.
  2. Underground piping.
  3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.09 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:
  - 1. Polyolefin

END OF SECTION

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FORMALLY KNOWN AS EL DORADO PARK  
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## SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.
- B. The OPR and BOD documentation are included by reference for information only.

#### 1.02 SUMMARY

- A. This section includes commissioning process requirements for Plumbing systems, assemblies, and equipment.
- B. Related Sections:
  - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

#### 1.03 DESCRIPTION

- A. Refer to Division 01 Section "General Commissioning Requirements" for the description of commissioning.

#### 1.04 DEFINITIONS

- A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

#### 1.05 SUBMITTALS

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.
- B. Refer to Division 01 Section "Submittals" for specific requirements. In addition, provide the following:
- C. Certificates of readiness
- D. Certificates of completion of installation, prestart, and startup activities.
- E. O&M manuals
- F. Test reports

#### 1.06 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments

immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

#### 1.07 COORDINATION

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

### PART 2 - PRODUCTS

#### 2.01 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the contractor for the equipment being tested. For example, the plumbing contractor of Division 22 shall ultimately be responsible for all standard testing equipment for the plumbing system in Division 22, except for equipment specific to and used by TAB in their commissioning responsibilities. A sufficient quantity of two-way radios shall be provided by each subcontractor.
- B. Special equipment, tools, and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. Data logging equipment and software required to test equipment will be provided by the CxA but shall not become the property of the Owner.
- E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

## PART 3 - EXECUTION

### 3.01 GENERAL DOCUMENTATION REQUIREMENTS

- A. The Installing Contractor shall prepare Pre-Functional Checklists for all commissioned components, equipment, and systems based on the manufacturers documentation and submit to the CxA for review and approval. This documentation shall be submitted with and within the same time frame as O&M literature.
- B. Red-lined Drawings:
  - 1. The contractor will verify all equipment, systems, instrumentation, wiring, and components are shown correctly on red-lined drawings.
  - 2. Preliminary, red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
  - 3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
  - 4. The contracted party, as defined in the Contract Documents will create the as-built drawings.
- C. Operation and Maintenance Data:
  - 1. Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
  - 2. The CxA will review the O&M literature once for conformance to project requirements.
  - 3. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the contractor.
- D. Demonstration and Training:
  - 1. Contractor will provide demonstration and training as required by the specifications.
  - 2. A complete training plan and schedule must be submitted by the contractor to the CxA four weeks (4) prior to any training.
  - 3. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session.
  - 4. The CxA shall be notified at least 72 hours in advance of scheduled tests so that testing may be observed by the CxA and Owner's representative. A copy of the test record shall be provided to the CxA, Owner, and Architect.
  - 5. Engage a Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
  - 6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
  - 7. Review data in O&M Manuals.
- E. Systems manual requirements:
  - 1. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.



2. The GC shall include final approved versions of the following information for the Systems Manual:
  - a. As-Built System Schematics
  - b. Verified Record Drawings
  - c. Test Results (not otherwise included in Cx Record)
  - d. Periodic Maintenance Information for computer maintenance management system
  - e. Recommendations for recalibration frequency of sensors and actuators
  - f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
  - g. Training Records, Information on training provided, attendees list, and any on-going training
3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, heating hot water, etc.
4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

### 3.02 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meetings.
- C. Attend domestic water balancing review and coordination meetings.
- D. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- G. Prepare preliminary schedule for Plumbing system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe, and duct system testing, flushing, and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.
- H. Update schedule as required throughout the construction period.
- I. During the startup and initial checkout process, execute prefunctional checklists for all commissioned equipment.
- J. Assist the CxA in all verification and functional performance tests.

- K. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- L. Gather operation and maintenance literature on all equipment and assemble in binders as required by the specifications. Submit to CxA (45) days after submittal acceptance.
- M. Coordinate with the CxA to provide (48) hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
- N. Notify the CxA a minimum of (2) weeks in advance of the time for start of the balancing work. Attend the initial balancing meeting for review of the balancing procedures.
- O. Participate in, and schedule vendors and contractors to participate in the training sessions.
- P. Provide written notification to the GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
  - 1. Plumbing equipment including domestic water heaters, pumps, heat exchangers, plumbing fixtures, and all other equipment furnished under this Division.
  - 2. Gas piping, condensate piping, and piping related to water reuse of condensate and/or stormwater.
- Q. The equipment supplier shall document the performance of his equipment.
- R. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.
- S. Balance Contractor
  - 1. Attend initial commissioning coordination meeting scheduled by the CxA.
  - 2. Submit the site-specific balancing plan to the CxA and Design Professional for review and acceptance.
  - 3. Attend the balancing review meeting scheduled by the CxA. Be prepared to discuss the procedures that shall be followed in balancing the Plumbing system.
  - 4. At the completion of the balancing work, and the submittal of the final balancing report, notify the Plumbing contractor and the CM/GC.
  - 5. At the completion of balancing work, and the submittal of the final balancing report, notify the Plumbing Contractor and the CM/GC.
  - 6. Participate in verification of the balancing report, which will consist of repeating measurements contained in the balancing reports. Assist in diagnostic purposes when directed.
- T. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

U. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
2. Assist in equipment testing per agreements with contractors.
3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

V. Refer to Division 01 Section "General Commissioning Requirements" for additional contractor responsibilities.

3.03 OWNER'S RESPONSIBILITIES

- A. Refer to Division 01 Section "General Commissioning Requirements" for Owner's Responsibilities.

3.04 DESIGN PROFESSIONAL'S RESPONSIBILITIES

- A. Refer to Division 01 Section "General Commissioning Requirements" for Design Professional's Responsibilities.

3.05 CxA'S RESPONSIBILITIES

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.06 TESTING PREPARATION

- A. Certify in writing to the CxA that Plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the CxA that Plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify in writing those balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

### 3.07 DOMESTIC WATER BALANCING VERIFICATION

- A. Prior to performance of Domestic Water Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least ten (10) days in advance of testing and balancing Work and provide access for the CxA to witness balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of Plumbing systems at the direction of the CxA.
  - 1. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
  - 2. The balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
  - 3. Failure of an item includes a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final balancing report.
  - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

### 3.08 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of Plumbing testing shall include entire Plumbing installation. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the Plumbing contractor, balancing subcontractor shall prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

### 3.09 PLUMBING SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 22 sections. Provide submittals, test data, inspector record, and certifications to the CxA.
- B. Plumbing Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in. Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 22 piping Sections. Plumbing Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
  - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
  - 2. Description of equipment for flushing operations.
  - 3. Minimum flushing water velocity.
  - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Plumbing Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of fuel gas, storm drainage piping, and domestic water distribution systems.
- E. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.
- F. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:

1. Service Water Heaters
2. Circulation Pumps
3. Hot Water Tempering Station
4. Plumbing Fixtures

### 3.10 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

### 3.11 APPROVAL

- A. Refer to Division 01 Section "General Commissioning Requirements" for approval procedures.

### 3.12 DEFERRED TESTING

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deferred testing.

### 3.13 OPERATION AND MAINTENANCE MANUALS

- A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.
- B. Refer to Division 01 Section "General Commissioning Requirements" for the AE and CxA roles in the Operation and Maintenance Manual contribution, review, and approval process.

### 3.14 TRAINING OF OWNER PERSONNEL

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to training.
- B. Plumbing Contractor. The mechanical contractor shall have the following training responsibilities:
  1. Provide the CxA with a training plan two weeks before the planned training.
  2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of Plumbing equipment.
  3. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary, and the demonstration repeated.
  4. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth

- knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
5. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
  6. Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for all pieces of equipment.
  7. The plumbing contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls.
  8. Training shall occur after functional testing is complete, unless approved otherwise by the Owner.

END OF SECTION

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 22 11 16 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
  - 2. Encasement for piping.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

#### 1.03 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

### PART 2 - PRODUCTS

#### 2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping, and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

#### 2.02 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type "L" and ASTM B 88, Type M water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type "L" water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.

3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Elkhart Products Corporation.
  - b. NIBCO Inc.
  - c. Viega.
3. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
4. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.03 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A 53/A 53M, Type E, Grade B, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Anvil International.
  - b. Grinnell Mechanical Products; Tyco Fire Products LP.
  - c. Shurjoint Piping Products.
  - d. Victaulic Company.

3. Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A 47/A 47M, malleable-iron casting; ASTM A 106/A 106M, steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Fittings for Grooved-End, Galvanized-Steel Pipe:
  - a. AWWA C606 for steel-pipe dimensions.
  - b. Ferrous housing sections.
  - c. EPDM-rubber gaskets suitable for hot and cold water.
  - d. Bolts and nuts.
  - e. Minimum Pressure Rating:
    - 1) NPS 8 and Smaller: 600 psig.

#### 2.04 CPVC PIPING

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.
  1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
  2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

#### 2.05 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D 1785, Schedule 40, and Schedule 80.
- B. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.
- C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

#### 2.06 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
  1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.07 TRANSITION FITTINGS

- A. General Requirements:
1. Same size as pipes to be joined.
  2. Pressure rating at least equal to pipes to be joined.
  3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Charlotte Pipe and Foundry Company.
    - b. Harvel Plastics, Inc.
    - c. Spears Manufacturing Company.
  3. Description:
    - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Colonial Engineering, Inc.
  - b. NIBCO Inc.
  - c. Spears Manufacturing Company.
3. Description:
  - a. CPVC or PVC four-part union.
  - b. Brass threaded end.
  - c. Solvent-cement-joint or threaded plastic end.
  - d. Rubber O-ring.
  - e. Union nut.

## 2.08 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. McDonald, A. Y. Mfg. Co.
    - b. Watts; a division of Watts Water Technologies, Inc.
    - c. Wilkins; a Zurn company.
  3. Standard: ASSE 1079.
  4. Pressure Rating: 150 psig.
  5. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
    - a. Watts; a division of Watts Water Technologies, Inc.
    - b. Wilkins; a Zurn company.
  3. Standard: ASSE 1079.
  4. Factory-fabricated, bolted, companion-flange assembly.
  5. Pressure Rating: 175 psig.
  6. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Pipeline Seal and Insulator, Inc.
  3. Nonconducting materials for field assembly of companion flanges.
  4. Pressure Rating: 150 psig.
  5. Gasket: Neoprene or phenolic.
  6. Bolt Sleeves: Phenolic or polyethylene.
  7. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Elster Perfection Corporation.
    - b. Grinnell Mechanical Products; Tyco Fire Products LP.
    - c. Precision Plumbing Products, Inc.
    - d. Victaulic Company.
  3. Standard: IAPMO PS 66.
  4. Electroplated steel nipple complying with ASTM F 1545.
  5. Pressure Rating and Temperature: 300 psig at 225 deg F.
  6. End Connections: Male threaded or grooved.
  7. Lining: Inert and noncorrosive, propylene.

## PART 3 - EXECUTION

### 3.01 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."

- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."
- F. Install domestic water piping level with 0.25 percent slope downward toward drain without pitch and plumb.
- G. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 22 11 23 "Domestic Water Pumps."
- R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."

- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### 3.02 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- H. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- I. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.



- J. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Piping: Join according to ASTM D 2855.
- K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.03 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.04 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  - 7. NPS 6: 12 feet with 3/4-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
  - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
  - 3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  - 4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 5. NPS 6: 48 inches with 3/4-inch rod.
  - 6. NPS 8: 48 inches with 7/8-inch rod.
- J. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- K. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
  - 2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6: 48 inches with 3/4-inch rod.
  - 5. NPS 8: 48 inches with 7/8-inch rod.
- L. Install supports for vertical PVC piping every 48 inches.

### 3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.07 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### 3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.09 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging procedures prescribed by authorities having jurisdiction or if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
  1. Soft copper tube, ASTM B 88, Type L wrought-copper, solder-joint fittings joints.
  2. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

- E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L ASTM B 88, wrought-copper, solder-joint fittings, soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 3. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
  - 4. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
  - 5. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 and NPS 2 CPVC pipe with CPVC socket fittings may be used instead of tubing.
  - 6. PVC, Schedule 80; socket fittings; and solvent-cemented joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L wrought-copper, solder-joint fittings, and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
  - 4. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
  - 5. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
- G. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L wrought-copper, solder-joint fittings, and brazed soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L grooved-joint, copper-tube appurtenances, and grooved joints.
  - 3. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
  - 4. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

### 3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  - 3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
  - 4. Drain Duty: Hose-end drain valves.

- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION

SAMARITAN'S PURSE PARK  
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## SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Hose bibbs.
3. Wall hydrants.
4. Water-hammer arresters.
5. Trap-seal primer valves.

B. Related Requirements:

1. Section 22 11 16 "Domestic Water Piping" for water meters.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

### PART 2 - PRODUCTS

#### 2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping, and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

#### 2.02 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.

3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome plated.

## 2.03 HOSE BIBBS

### A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome plated.
10. Finish for Finished Rooms: Chrome plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome-plated hose bibb.

## 2.04 WALL HYDRANTS

### A. Vacuum Breaker Wall Hydrants:

1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Pressure Rating: 125 psig (860 kPa).
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
7. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

## 2.05 WATER-HAMMER ARRESTERS

### A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Precision Plumbing Products, Inc.
  - d. Sioux Chief Manufacturing Company, Inc.
  - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Watts Drainage Products.
  - g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.06 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. MIFAB, Inc.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  2. Standard: ASSE 1018.
  3. Pressure Rating: 125 psig (860 kPa) minimum.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
  6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
  7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- B. Set non-freeze, non-draining-type post hydrants in concrete or pavement.
- C. Install water-hammer arresters in water piping according to PDI-WH 201.
- D. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

### 3.02 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

### 3.03 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

END OF SECTION

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## SECTION 22 11 26 - DOMESTIC-WATER PACKAGED BOOSTER PUMPS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Multiplex, variable-speed booster pumps.
- B. Related Sections:
  - 1. Section 22 11 25 "Domestic Water Pumps" for domestic-water circulation pumps.

#### 1.03 DEFINITIONS

- A. VFC: Variable-frequency controller(s).

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Booster pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the booster pump will remain in place without separation of any parts from the booster pump when subjected to the seismic forces specified and the booster pump will be fully operational after the seismic event."

#### 1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For booster pumps. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

## 1.06 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For booster pumps, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

## 1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.

## 1.08 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Comply with ASME B31.9 for piping.
- C. UL Compliance for Packaged Pumping Systems:
  - 1. UL 508, "Industrial Control Equipment."
  - 2. UL 508A, "Industrial Control Panels."
  - 3. UL 778, "Motor-Operated Water Pumps."
  - 4. UL 1995, "Heating and Cooling Equipment."
- D. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

## 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Retain protective coatings and flange's protective covers during storage.

## 1.10 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

### 2.01 MULTIPLEX, VARIABLE-SPEED BOOSTER PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong Pumps, Inc.
  - 2. Canariis Corporation.

3. QuantumFlow.
  4. Grundfos.
- B. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.
- C. Pumps:
1. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
  2. Casing: Radially split; stainless steel.
  3. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
  4. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
  5. Seal: Mechanical.
  6. Orientation: Mounted horizontally.
- D. Motors: ODP, premium efficiency and VFD rated (Inverter Duty), with pre-greased, permanently shielded, ball-type bearings. Select motors that will not overload through full range of pump performance curve.
- E. Piping: Stainless-steel pipe and fittings.
- F. Valves:
1. Shutoff Valves NPS 2 (DN 50) and Smaller: two-piece, full-port ball valve, in each pump's suction and discharge piping.
  2. Shutoff Valves NPS 2-1/2 (DN 65) and large lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers.
  3. Check Valves NPS 2 (DN 50) and Smaller: Silent type in each pump's discharge piping.
  4. Check Valves NPS 2-1/2 (DN 65) and Larger: Silent type in each pump's discharge piping.
  5. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.
- G. Dielectric Fittings: With insulating material isolating joined dissimilar metals.
- H. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, variable-speed operation, with load control and protection functions.
1. Control Logic: Solid-state system with transducers, programmable microprocessor, VFC, and other devices in controller.
  2. Motor Controller: NEMA ICS 2, variable-frequency, solid-state type.
    - a. Control Voltage: 120-V ac, with integral control-power transformer.
  3. Enclosure: NEMA 250, Type 1.
  4. Motor Overload Protection: Overload relay in each phase.
  5. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.



- a. Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.
6. Pump Operation and Sequencing: Pressure-sensing method for lead pump and flow-sensing method for lag pumps.
  - a. Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.
7. VFC: Voltage-source, pulse-width, modulating-frequency converter for each pump.
8. Manual Bypass: Magnetic contactor arranged to transfer to constant-speed operation upon VFC failure.
9. Instrumentation: Suction and discharge pressure gages.
10. Lights: Running light for each pump.
11. Alarm Signal Device: Sounds alarm when backup pumps are operating.
  - a. Time Delay: Controls alarm operation; adjustable from 1 to 300 seconds, with automatic reset.
12. Thermal-bleed cutoff.
13. Low-suction-pressure cutout.
14. High-suction-pressure cutout.
15. Low-discharge-pressure cutout.
16. High-discharge-pressure cutout.
17. Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to BACnet DDC system. Include the following:
  - a. On-off status of each pump.
  - b. Alarm status.

I. Base: Structural steel.

## 2.02 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
  1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.

### 3.02 INSTALLATION

- A. Equipment Mounting:

1. Install booster pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
  2. Comply with requirements for vibration isolation and seismic control devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment"
- B. Support connected domestic water piping, so weight of piping is not supported by booster pumps.

### 3.03 CONNECTIONS

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge headers.
1. Install shutoff valves on piping connections to booster-pump suction and discharge headers. Install ball valves same size as suction and discharge headers. Comply with requirements for ball valves for plumbing piping, Section 22 05 23.
  2. Install union or flanged connections on suction and discharge headers at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Section 22 11 16 "Domestic Water Piping."
  3. Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge headers. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic Water Piping."
  4. Install piping adjacent to booster pumps to allow service and maintenance.

### 3.04 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### 3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
1. Perform visual and mechanical inspection.
  2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Pumps and controls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.06 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.07 ADJUSTING

- A. Adjust booster pumps to function smoothly and lubricate as recommended by manufacturer.
- B. Adjust pressure set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.08 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION

## SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.

#### 1.02 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
  - 2. Waste, Force-Main Piping: 50.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

#### 1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

## PART 2 - PRODUCTS

### 2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. MIFAB, Inc.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
    - d. Clamp all Corp.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Dallas Specialty & Mfg. Co.
    - d. MIFAB, Inc.
    - e. Mission Rubber Company; a division of MCP Industries, Inc.
    - f. Stant.
    - g. Tyler Pipe.

### 2.03 GALVANIZED-STEEL PIPE AND FITTINGS

- A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.
- B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.
- C. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
  2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
  3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- D. Cast-Iron Flanges: ASME B16.1, Class 125.
1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

## 2.04 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type M, water tube, drawn temper.
- D. Copper Pressure Fittings:
1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.05 ABS PIPE AND FITTINGS

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- C. Solvent Cement: ASTM D 2235.
1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.06 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
  1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.07 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  3. Unshielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Dallas Specialty & Mfg. Co.
      - 2) Fernco Inc.
      - 3) Mission Rubber Company; a division of MCP Industries, Inc.
      - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

- 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
  4. Shielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cascade Waterworks Mfg. Co.
      - 2) Mission Rubber Company; a division of MCP Industries, Inc.
    - b. Standard: ASTM C 1460.
    - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  5. Pressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cascade Waterworks Mfg. Co.
      - 2) Dresser, Inc.
      - 3) JCM Industries, Inc.
      - 4) Smith-Blair, Inc.; a Sensus company.
      - 5) Viking Johnson.
    - b. Standard: AWWA C219.
    - c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    - d. Center-Sleeve Material: Manufacturer's standard.
    - e. Gasket Material: Natural or synthetic rubber.
    - f. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
  1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
  2. Dielectric Unions:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) McDonald, A. Y. Mfg. Co.
      - 2) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      - 3) Wilkins; a Zurn company.
    - b. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 125 psig minimum at 180 deg F.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
  3. Dielectric Flanges:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      - 2) Wilkins; a Zurn company.
    - b. Description:
      - 1) Standard: ASSE 1079.



- 2) Factory-fabricated, bolted, companion-flange assembly.
  - 3) Pressure Rating: 125 psig minimum at 180 deg F.
  - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Advance Products & Systems, Inc.
    - 2) Calpico, Inc.
    - 3) Pipeline Seal and Insulator, Inc.
  - b. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Elster Perfection.
    - 2) Grinnell Mechanical Products.
    - 3) Precision Plumbing Products, Inc.
    - 4) Victaulic Company.
  - b. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple.
    - 3) Pressure Rating: 300 psig at 225 deg F.
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

## 2.08 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black.

## PART 3 - EXECUTION

### 3.01 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install steel piping according to applicable plumbing code.

- O. Install aboveground ABS piping according to ASTM D 2661.
- P. Install aboveground PVC piping according to ASTM D 2665.
- Q. Install underground ABS and PVC piping according to ASTM D 2321.
- R. Install underground, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.
- S. Install force mains at elevations indicated.
- T. Plumbing Specialties:
  - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
  - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
- U. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### 3.02 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.03 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  1. Install transition couplings at joints of piping with small differences in OD's.
  2. In Drainage Piping: Shielded, nonpressure transition couplings.
  3. In Aboveground Force Main Piping: Fitting-type transition couplings.
  4. In Underground Force Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
  1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples union.
  3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
  4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.

3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  6. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  2. NPS 3: 48 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
  5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- I. Install supports for vertical ABS and PVC piping every 48 inches.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.05 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Comply with requirements for cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
  - 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
  - 1. Sanitary Sewer: To exterior force main.
  - 2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.06 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### 3.07 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 4. Prepare reports for tests and required corrective action.

### 3.08 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

### 3.09 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings CISPI heavy-duty hubless-piping couplings; and coupled joints.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
- E. Aboveground, vent piping NPS 5 and larger shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; ISPI heavy-duty hubless-piping couplings; and coupled joints.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.
  - 2. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
  - 3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; coupled joints.
  - 2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:
  - 1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:
  - 1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  - 2. Galvanized-steel pipe, pressure fittings, and threaded joints.



3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- J. Underground sanitary-sewage force mains NPS 4 and smaller shall be any of the following:
  1. Hard Soft copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
  2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.
- K. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:
  1. Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
  2. Pressure transition couplings if dissimilar pipe materials.

END

OF

SECTION

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Roof flashing assemblies.
  - 4. Miscellaneous sanitary drainage piping specialties.
  - 5. Flashing materials.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

#### 1.03 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.01 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Josam Company.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.
    - d. Watts Drainage Products.
    - e. Zurn Plumbing Products Group.
  - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
  - 3. Size: Same as connected drainage piping
  - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 5. Closure: Countersunk Raised-head, cast-iron plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Josam Company; Josam Div.
    - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

- c. Watts Drainage Products Inc.
    - d. Zurn Plumbing Products Group; Light Commercial Operation.
    - e. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
  - 3. Size: Same as connected branch.
  - 4. Type: Threaded, adjustable housing.
  - 5. Body or Ferrule: Cast iron.
  - 6. Clamping Device: Not required.
  - 7. Outlet Connection: Threaded.
  - 8. Closure: Brass plug with tapered threads.
- C. Cast-Iron Wall Cleanouts:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Watts Drainage Products Inc.
    - e. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M. Include wall access.
  - 3. Size: Same as connected drainage piping.
  - 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 5. Closure: brass plug.
  - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  - 7. Wall Access: Round, stainless-steel cover plate with screw.
  - 8. Wall Access: Round, wall-installation frame, and cover.

## 2.02 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Commercial Enameling Co.
    - b. Josam Company; Josam Div.
    - c. MIFAB, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Light Commercial Operation.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.6.3.
  - 3. Pattern: Area Floor Funnel Floor Sanitary drain.
  - 4. Clamping Device: Required.
  - 5. Outlet: Bottom.
  - 6. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
  - 7. Top or Strainer Material: Nickel bronze.
  - 8. Top of Body and Strainer Finish: Polished bronze.
  - 9. Top Shape: Round or Square.

10. Funnel: Required at resident units.
11. Trap Material: Cast iron.
12. Trap Pattern: Standard P-trap.

## 2.03 ROOF FLASHING ASSEMBLIES

### A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.
2. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
  - a. Open-Top Vent Cap: Without cap.
  - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
  - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.04 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

### B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

### C. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

## 2.05 FLASHING MATERIALS

### A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

### B. Fasteners: Metal compatible with material and substrate being fastened.

- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- G. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- I. Install air-gap fittings on indirect-waste piping discharge into sanitary drainage system.
- J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- K. Install vent caps on each vent pipe passing through roof.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.02 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.03 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 62 00 "Sheet Metal Flashing and Trim."

- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### 3.04 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### 3.05 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION



## SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
- B. Related Section:
  - 1. Section 33 41 00 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.03 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.
- B. Field quality-control reports.

#### 1.04 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.01 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

#### 2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Mission Rubber Company; a division of MCP Industries, Inc.
    - c. Tyler Pipe.
    - d. AB&I.

- e. Charlotte Pipe
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
    - d. Tyler Pipe.
    - e. AB&I.
    - f. Charlotte Pipe
  - 2. Standards: ASTM C 1277 and ASTM C 1540.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.03 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
- 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
  - 3. Unshielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Fernco Inc.
      - 2) Mission Rubber Company; a division of MCP Industries, Inc.
      - 3) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 4. Shielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - b. Standard: ASTM C 1460.
    - c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

## PART 3 - EXECUTION

### 3.01 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

### 3.02 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install storm drainage piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Horizontal Storm-Drainage Piping: 1 percent downward in direction of flow.

- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- L. Plumbing Specialties:
  - 1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 22 14 23 "Storm Drainage Piping Specialties."
  - 2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 22 14 23 "Storm Drainage Piping Specialties."
  - 3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 14 23 "Storm Drainage Piping Specialties."
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### 3.03 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

### 3.04 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, nonpressure transition couplings.

### 3.05 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  - 2. Install backwater valves in accessible locations.
  - 3. Comply with requirements for backwater valves specified in Section 22 14 23 "Storm Drainage Piping Specialties."

### 3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - a. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
  - b. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
  - c. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.

- d. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

### 3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
  - 2. Install horizontal backwater valves with cleanout cover flush with floor.
  - 3. Comply with requirements for backwater valves cleanouts and drains specified in Section 22 14 23 "Storm Drainage Piping Specialties."
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### 3.08 IDENTIFICATION

- A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

### 3.09 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

### 3.10 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

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## SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Roof drains.
  - 2. Trench drains.
  - 3. Flashing materials.

#### 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.03 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.01 TRENCH DRAINS

- A. Trench Drains:
  - 1. Standard: ASME A112.6.3, for trench drains.
  - 2. Body Material: Cast iron or polypropylene.
  - 3. Flange: Anchor.
  - 4. Clamping Device: Required.
  - 5. Outlet: Bottom.
  - 6. Grate Material: Ductile iron.
  - 7. Top-Loading Classification: Heavy Duty.

#### 2.02 FLASHING MATERIALS

- A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

C. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

### 3.02 CONNECTIONS

A. Comply with requirements for piping specified in Section 22 14 13 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.03 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. (30-kg/sq. m) lead sheets, 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of 4.0-lb/sq. ft. (20-kg/sq. m) lead sheets, 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches (250 mm) and with skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.04 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END

OF

SECTION

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## SECTION 22 40 00 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes the following:
  - 1. Faucets for lavatories, bathtub/showers, and sinks.
  - 2. Toilet seats.
  - 3. Protective shielding guards.
  - 4. Fixture supports.
  - 5. Dishwasher air-gap fittings.
  - 6. Disposers.
  - 7. Water closets.
  - 8. Urinals.
  - 9. Lavatories.
  - 10. Bathtubs.
  - 11. Individual showers.
  - 12. Kitchen sinks.
  - 13. Service sinks.
  - 14. Laundry trays.

#### 1.02 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

#### 1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

#### 1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act" for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Plastic Laundry Trays: ANSI Z124.6.
  - 3. Plastic Shower Enclosures: ANSI Z124.2.
  - 4. Plastic Sinks: ANSI Z124.6.
  - 5. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 6. Slip-Resistant Bathing Surfaces: ASTM F 462.
  - 7. Stainless-Steel Residential Sinks: ASME A112.19.3.
  - 8. Vitreous-China Fixtures: ASME A112.19.2M.
- G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - 4. Faucets: ASME A112.18.1.
  - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
  - 6. Hose-Coupling Threads: ASME B1.20.7.
  - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - 8. NSF Potable-Water Materials: NSF 61.
  - 9. Pipe Threads: ASME B1.20.1.
  - 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  - 11. Supply Fittings: ASME A112.18.1.
  - 12. Brass Waste Fittings: ASME A112.18.2.

- H. Comply with the following applicable standards and other requirements specified for bathtub/shower faucets:
1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
  2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  3. Faucets: ASME A112.18.1.
  4. Hand-Held Showers: ASSE 1014.
  5. High-Temperature-Limit Controls for Thermal shock preventing Devices: ASTM F 445.
  6. Hose-Coupling Threads: ASME B1.20.7.
  7. Manual-Control Antiscald Faucets: ASTM F 444.
  8. Pipe Threads: ASME B1.20.1.
  9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
  10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
  2. Brass and Copper Supplies: ASME A112.18.1.
  3. Dishwasher Air-Gap Fittings: ASSE 1021.
  4. Plastic Tubular Fittings: ASTM F 409.
  5. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
  2. Dishwasher Air-Gap Fittings: ASSE 1021.
  3. Flexible Water Connectors: ASME A112.18.6.
  4. Grab Bars: ASTM F 446.
  5. Hose-Coupling Threads: ASME B1.20.7.
  6. Off-Floor Fixture Supports: ASME A112.6.1M.
  7. Pipe Threads: ASME B1.20.1.
  8. Plastic Toilet Seats: ANSI Z124.5.
  9. Supply and Drain Protective Shielding Guards: ICC A117.1.

## PART 2 - PRODUCTS

### 2.01 LAVATORY FAUCETS

- A. Lavatory Faucets:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Bradley Corporation.
  - c. Brasstech Inc.; Newport Brass Div.
  - d. Broadway Collection.
  - e. Central Brass Manufacturing Company.
  - f. Chicago Faucets.
  - g. Delta Faucet Company.
  - h. Eljer.
  - i. Elkay Manufacturing Co.
  - j. Fisher Manufacturing Co.
  - k. Franke Consumer Products, Inc.; Kitchen Systems Div.
  - l. Gerber Plumbing Fixtures LLC.
  - m. Geberit Manufacturing, Inc.
  - n. Grohe America, Inc.
  - o. Hansgrohe Inc.
  - p. Hydrotek International, Inc.
  - q. Intersan Manufacturing Company.
  - r. Just Manufacturing Company.
  - s. Kohler Co.
  - t. Moen, Inc.
  - u. Pegler, Ltd.
  - v. Price Pfister, Inc.
  - w. Rohl LLC.
  - x. Royal Brass Mfg. Co.
  - y. Sayco; a Briggs Plumbing Products, Inc. Company.
  - z. Speakman Company.
  - aa. T & S Brass and Bronze Works, Inc.
  - bb. Water Management, Inc.
  - bb. Wolverine Brass, Inc.
  - cc. Zurn Plumbing Products Group; Commercial Brass Operation.
4. Description: Two-handle mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: Residential, metallic underbody with brass cover plate.
  - b. Finish: Polished chrome plate.
  - c. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
  - d. Centers: 4 inches (102 mm)]
  - e. Mounting: Deck, exposed.
  - f. Valve Handle(s): Lever.
  - g. Inlet(s): NPS 3/8 (DN 10) tubing, plain end.
  - h. Spout: Rigid type.
  - i. Spout Outlet: Aerator.
  - j. Drain: Pop up

## 2.02 BATHTUB FAUCETS

### A. Bathtub Faucets:



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Brasstech Inc.; Newport Brass Div.
  - c. Broadway Collection.
  - d. Central Brass Manufacturing Company.
  - e. Delta Faucet Company.
  - f. Eljer.
  - g. Gerber Plumbing Fixtures LLC.
  - h. Grohe America, Inc.
  - i. Hansgrohe Inc.
  - j. Kohler Co.
  - k. Moen, Inc.
  - l. Paul Decorative Products.
  - m. Pegler, Ltd.
  - n. Powers; a Watts Industries Co.
  - o. Royal Brass Mfg. Co.
  - p. Sayco; a Briggs Plumbing Products, Inc. Company.
  - q. Speakman Company.
  - r. Sterling Plumbing Group, Inc.
  - s. St. Thomas Creations.
  - t. Symmons Industries, Inc.
  - u. T & S Brass and Bronze Works, Inc.
  - v. Wolverine Brass, Inc.
4. Description: Single control mixing valve. Include hot- and cold-water indicators and tub spout. Coordinate faucet inlets with supplies.
  - a. Body Material: Solid brass.
  - b. Finish: Polished chrome plate.
  - c. Mounting: Wall.
  - d. Valve Handle(s): Knob.
  - e. Bathtub Spout: Chrome-plated brass with diverter.
  - f. Supply Connections: NPS 1/2 (DN 15)

## 2.03 SHOWER FAUCETS

### A. Shower Faucets:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.

- b. Brasstech Inc.; Newport Brass Div.
  - c. Broadway Collection.
  - d. Central Brass Manufacturing Company.
  - e. Chicago Faucets.
  - f. Delta Faucet Company.
  - g. Eljer.
  - h. Gerber Plumbing Fixtures LLC.
  - i. Hansgrohe Inc.
  - j. Kohler Co.
  - k. Leonard Valve Company.
  - l. Moen, Inc.
  - m. Paul Decorative Products.
  - n. Pegler, Ltd.
  - o. Powers; a Watts Industries Co.
  - p. Price Pfister, Inc.
  - q. Rohl LLC.
  - r. Royal Brass Mfg. Co.
  - s. Sayco; a Briggs Plumbing Products, Inc. Company.
  - t. Speakman Company.
  - u. Sterling Plumbing Group, Inc.
  - v. St. Thomas Creations.
  - w. Symmons Industries, Inc.
  - x. T & S Brass and Bronze Works, Inc.
  - y. Wolverine Brass, Inc.
  - z. Zurn Plumbing Products Group; AquaSpec Commercial Faucet Operation.
  - aa. Zurn Plumbing Products Group; Wilkins Operation.
4. Description: Single-handle thermostatic valve. Include hot- and cold-water indicators; check stops; and shower head, arm, and flange. Coordinate faucet inlets with supplies and outlet with diverter valve.
- a. Body Material: Solid brass with nonmetallic trim.
  - b. Finish: Polished chrome plate
  - c. Maximum Flow Rate: 1.75 gpm unless otherwise indicated.
  - d. Mounting: Exposed
  - e. Antiscald Device: Integral with mixing valve.
  - f. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
  - g. Supply Connections: NPS 1/2 (DN 15).
  - h. Shower Head Type: Ball joint
  - i. Shower Head Material: Metallic with chrome-plated finish.
  - j. Spray Pattern: Adjustable.

## 2.04 KITCHEN SINK FAUCETS

- A. Sink Faucets:
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Bradley Corporation.
  - c. Brasstech Inc.; Newport Brass Div.
  - d. Broadway Collection.
  - e. Central Brass Manufacturing Company.
  - f. Chicago Faucets.
  - g. Delta Faucet Company.
  - h. Eljer.
  - i. Elkay Manufacturing Co.
  - j. Fisher Manufacturing Co.
  - k. Franke Consumer Products, Inc.; Kitchen Systems Div.
  - l. Gerber Plumbing Fixtures LLC.
  - m. Grohe America, Inc.
  - n. Hansgrohe Inc.
  - o. Hydrotek International, Inc.
  - p. Intersan Manufacturing Company.
  - q. Just Manufacturing Company.
  - r. Kohler Co.
  - s. Moen, Inc.
  - t. Pegler, Ltd.
  - u. Price Pfister, Inc.
  - v. Rohl LLC.
  - w. Royal Brass Mfg. Co.
  - x. Sayco; a Briggs Plumbing Products, Inc. Company.
  - y. Speakman Company.
  - z. T & S Brass and Bronze Works, Inc. aa. Water Management, Inc.
  - aa. bb. Wolverine Brass, Inc.
  - bb. cc. Zurn Plumbing Products Group; Commercial Brass Operation.
4. Description: Kitchen faucet with spray, three-hole fixture. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: General-duty, solid brass
  - b. Finish: Polished chrome plate
  - c. Maximum Flow Rate: 1.75 gpm unless otherwise indicated.
  - d. Mixing Valve: Single control.
  - e. Centers: 4 inches (102 mm).
  - f. Mounting: Deck.
  - g. Handle(s): Lever
  - h. Inlet(s): NPS 3/8 (DN 10) plain-end tubing]
  - i. Spout Type: Swing, solid brass.
  - j. Spout Outlet: Swivel aerator/spray.
  - k. Drain: Stopper.

## 2.05 TOILET SEATS

### A. Toilet Seats:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Bemis Manufacturing Company.
  - c. Centoco Manufacturing Corp.
  - d. Church Seats.
  - e. Eljer.
  - f. Kohler Co.
  - g. Olsonite Corp.
  - h. Sanderson Plumbing Products, Inc.; Beneke Div.
  - i. Sperzel.
4. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic.
  - b. Configuration: Closed with cover.
  - c. Size: Elongated.
  - d. Class: Residential.
  - e. Color: White.

## 2.06 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Engineered Brass Co.
    - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
    - c. McGuire Manufacturing Co., Inc.
    - d. Plumberex Specialty Products Inc.
    - e. TCI Products.
    - f. TRUEBRO, Inc.
    - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
  3. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold- water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.07 FIXTURE SUPPORTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Josam Company.
  - 2. MIFAB Manufacturing Inc.
  - 3. Smith, Jay R. Mfg. Co.
  - 4. Tyler Pipe; Wade Div.
  - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- C. Water-Closet Supports
  - 1. Description: Combination carrier designed for accessible and standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical, or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

## 2.08 DISHWASHER AIR-GAP FITTINGS

- A. Dishwasher Air-Gap Fittings:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. B & K Industries, Inc.
    - b. Brass Craft Mfg. Co.; a Subsidiary of Masco Corporation.
    - c. Brasstech Inc.; Newport Brass Div.
    - d. Dearborn Brass; a div. of Moen, Inc.
    - e. Geberit Manufacturing, Inc.
    - f. JB Products; a Federal Process Corporation Company.
    - g. Sioux Chief Manufacturing Company, Inc.
    - h. Watts Brass & Tubular; a division of Watts Regulator Co.
  - 3. Description: Fitting suitable for use with domestic dishwashers and for deck mounting; with plastic body, chrome-plated brass cover; and capacity of at least 5 gpm (0.32 L/s); and inlet pressure of at least 5 psig (35 kPa) at a temperature of at least 140 deg F (60 deg C). Include 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet hose connections.
  - 4. Hoses: Rubber and suitable for temperature of at least 140 deg F (60 deg C).
    - a. Inlet Hose: 5/8-inch (16-mm) ID and 48 inches (1219 mm) long.
    - b. Outlet Hose: 7/8-inch (22-mm) ID and 48 inches (1219 mm) long.

## 2.09 DISPOSERS

- A. Disposers,
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Franke Consumer Products, Inc.; Kitchen Systems Div.
  - c. In-Sink-Erator; a div. of Emerson Electric Co.
  - d. KitchenAid.
  - e. Maytag Co.
4. Description: Batch-feed household, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 (DN 40) outlet; quick-mounting, stainless-steel sink flange; anti splash guard; and combination cover/stopper.
  - a. Type: Batch-feed household.
  - b. Motor: 115-V ac, 1725 rpm, 1/2 hp with overload protection.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install fixtures level and plumb according to roughing-in drawings.
- F. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- G. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- H. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- I. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

- J. Install toilet seats on water closets.
- K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- O. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- P. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- Q. Install dishwasher airgap fitting at each sink indicated to have airgap fitting. Install [in sink deck] [on countertop at sink] <Insert location>. Connect inlet hose to dishwasher and outlet hose to disposer.
- R. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- S. Set bathtubs in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### 3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.03 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.04 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION



SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Floor-mounted, bottom-outlet water closets.
  - 2. Wall-mounted water closet
  - 3. Flushometer valves.
  - 4. Toilet seats.
  - 5. Supports.
- B. Related Requirements:
  - 1. Section 22 13 16 "Sanitary Waste and Vent Piping.

#### 1.3 DEFINITIONS

- A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.
- B. Remote Water Closet: Located more than 30 feet (9.1 m) from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

## PART 2 - PRODUCTS

### 2.1 WALL-MOUNTED, BACK-OUTLET WATER CLOSET

- A. Water Closets - Wall Mounted, Back Outlet, refer to plumbing fixture schedule on drawing:
  - 1. Manufacturer:
    - a. Kohler Company
    - b. American Standard Company
    - c. Zurn Industries
    - d. Sloan Company
  - 2. Source Limitations: Obtain water closets from single source from single manufacturer.
  - 3. Bowl: Elongated
    - a. Material: Vitreous China.
    - b. Type: Siphon jet.
    - c. Style: Flushometer Valve.
    - d. Height: 17"-19" Floor to Bowl Rim.
    - e. Rim Contour: Elongated.
    - f. Water Consumption: 1.1 gal. or 1.28 gal. per flush.
    - g. Color: White.

### 2.2 FLUSHOMETER VALVES

- A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Sloan Valve Company.

- b. Zurn Industries, LLC.
- 2. Standard: ASSE 1037.
- 3. Minimum Pressure Rating: 125 psig (860 kPa).
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Panel Finish: Chrome plated or stainless steel.
- 8. Style: Concealed
- 9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 11. Consumption: 1.28 gal. per flush.
- 12. Minimum Inlet: NPS 1 (DN 25).
- 13. Minimum Outlet: NPS 1-1/4 (DN 32).

## 2.3 TOILET SEATS

### A. Toilet Seats:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Church Seats; Bemis Manufacturing Company.
  - b. Kohler Co.
- 2. Standard: IAPMO/ANSI Z124.5.
- 3. Material: Plastic.
- 4. Type: Commercial (Heavy duty).
- 5. Shape: Elongated rim, open front.
- 6. Hinge: Self-sustaining, check.
- 7. Hinge Material: Noncorroding metal.
- 8. Seat Cover: Not required.
- 9. Color: White

## 2.4 SUPPORTS

### A. Water Closet Carrier:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg Co; a division of Morris Group International.
  - b. Josam Company.

- c. MIFAB, Inc.
- d. Zurn Industries, LLC.
- 2. Standard: ASME A112.6.1M.
- 3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

#### A. Water-Closet Installation:

- 1. Install level and plumb according to roughing-in drawings.
- 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

#### B. Support Installation:

- 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- 2. Use carrier supports with waste-fitting assembly and seal.
- 3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
- 4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

#### C. Flushometer-Valve Installation:

- 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### 3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

### 3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

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## SECTION 22 42 13.16 - COMMERCIAL URINALS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Wall-hung urinals.
  - 2. Urinal flushometer valves.
  - 3. Supports.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

## PART 2 - PRODUCTS

### 2.1 WALL-HUNG URINALS

#### A. Urinals - Wall Hung, Back Outlet, Siphon Jet: Accessible

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Kohler Co.
  - c. Zurn Industries, LLC.
2. Fixture:
  - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5/CSA B45.15.
  - b. Material: Vitreous china.
  - c. Type: Siphon jet with extended shields.
  - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
  - e. Water Consumption: 0.125 gpf (0.5 Lpf)
  - f. Spud Size and Location: NPS 3/4 (DN 20); top
  - g. Outlet Size and Location: NPS 2 (DN 50); back.
  - h. Color: White
3. Flushometer Valve
4. Waste Fitting:
  - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
  - b. Size: NPS 2 (DN 50).
5. Support: Type I urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
6. Urinal Mounting Height: Handicapped/elderly according to ICC A117.1.

#### B. Urinals - Wall Hung, Bottom Outlet, Washout:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard.
  - b. Kohler.
  - c. Zurn Industries, LLC.
2. Fixture:

- a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5/CSA B45.15.
  - b. Material: Vitreous china.
  - c. Drain: Separate removable chrome-plated dome strainer with chrome-plated, NPS 1-1/2 (DN 40) tailpiece.
  - d. Strainer or Trapway: Manufacturer's standard strainer and NPS 1-1/2 (DN 40) tailpiece.
  - e. Inlet Spud Size and Location: NPS 3/4 (DN 20); top.
  - f. Outlet Size and Location: NPS 1-1/2 (DN 40); bottom.
  - g. Color: White.
  - h. Water Consumption: 0.125 gpf (0.5 Lpf)
3. Flushometer Valve:
4. Waste Fitting:
- a. Standard: ASME A112.18.2/CSA B125.2.
  - b. Trap:
    - 1) Size: NPS 1-1/2 (DN 50).
    - 2) Material, Chrome Plated: Two-piece, cast-brass trap and swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall and chrome-plated brass or steel wall flange.
    - 3) Material, Stainless Steel: Two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick, stainless steel tube to wall; and stainless steel wall flange.
5. Support: Type II urinal carrier with hanger and bearing plates. Include rectangular, steel uprights.
6. Urinal Mounting Height: Standard, Handicapped/elderly according to ICC A117.1.

## 2.2 URINAL FLUSHOMETER VALVES

### A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Sloan Valve Company.
  - b. Zurn Industries, LLC.
- 2. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
- 3. Minimum Pressure Rating: 125 psig (860 kPa).
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Panel Finish: Chrome plated or stainless steel.
- 8. Style: Concealed.

9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 0.125 GAL per flush
12. Minimum Inlet: NPS 3/4 (DN 20)
13. Minimum Outlet: NPS 3/4 (DN 20)

## 2.3 SUPPORTS

### A. Type I Urinal Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg Co; a division of Morris Group International.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

### B. Type II Urinal Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg Co; a division of Morris Group International.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

### C. Type I Sink Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jay R. Smith Mfg Co; a division of Morris Group International.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Zurn Industries, LLC.
2. Standard: ASME A112.6.1M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. Urinal Installation:

- 1. Install urinals level and plumb according to rough-in drawings.
- 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
- 3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
- 4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC A117.1.
- 5. Install trap-seal liquid in waterless urinals.

#### B. Support Installation:

- 1. Install supports, affixed to building substrate, for wall-hung urinals.
- 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
- 3. Use carriers without waste fitting for urinals with tubular waste piping.
- 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

#### C. Flushometer-Valve Installation:

- 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
- 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

#### D. Wall Flange and Escutcheon Installation:

- 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
- 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

## SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Vitreous-china, counter-mounted lavatories
  - 2. Vitreous-china, wall mounted lavatories.
  - 3. Automatically operated lavatory faucets.
  - 4. Supply fittings.
  - 5. Waste fittings.
  - 6. Lavatory supports.
- B. Related Requirements:

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Servicing and adjustments of automatic faucets.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

## PART 2 - PRODUCTS

### 2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

- A. Lavatory - Self-Rimming, Rectangular, Vitreous China, Counter Mounted
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kohler Co.
    - b. TOTO USA, INC.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: Self-rimming for above-counter mounting.
    - c. Nominal Size: Rectangular, 21 by 19 inches
    - d. Faucet-Hole Punching: Three holes, 4-inch centers.
    - e. Faucet-Hole Location: Top.
    - f. Color: White.
    - g. Mounting Material: Sealant.
  - 3. Faucet: Automatically Operated Lavatory Faucets
- B. Lavatory - Self-Rimming, Vitreous China, Counter Mounted



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Plumbing, L.L.C.
  - b. Kohler Co.
  - c. Sloan Valve Company.
  - d. TOTO USA, INC.
  - e. Zurn Industries, LLC.
2. Fixture:
  - a. Standard: ASME A112.19.2/CSA B45.1.
  - b. Type: Self-rimming for above-counter mounting.
  - c. Nominal Size:
    - 1) Oval, 19 by 17 inches, 20 by 17 inches
  - d. Faucet-Hole Punching: Three holes, 4-inch (102-mm) centers.
  - e. Faucet-Hole Location: Top.
  - f. Color: White
  - g. Mounting Material: Sealant.
3. Faucet: Automatically Operated Lavatory Faucets

C. Lavatory - Vitreous China, Undercounter Mounted:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Kohler Co.
  - b. Sloan Valve Company.
  - c. Zurn Industries, LLC.
2. Fixture:
  - a. Standard: ASME A112.19.2/CSA B45.1.
  - b. Type: For undercounter mounting.
  - c. Nominal Size: Oval, 19 by 16 inches
  - d. Faucet-Hole Punching: No holes.
  - e. Faucet-Hole Location: On countertop.
  - f. Color: White.
  - g. Mounting Material: Sealant and undercounter mounting kit.
3. Faucet: Automatically Operated Lavatory Faucets

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory - Vitreous China, Wall Mounted, with Back

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Kohler Co.
  - b. Sloan Valve Company.
  - c. Zurn Industries, LLC.
2. Fixture:
  - a. Standard: ASME A112.19.2/CSA B45.1.
  - b. Type: For wall hanging.
  - c. Nominal Size: Rectangular, (20 by 18 inches (508 by 457 mm)
  - d. Faucet-Hole Punching
  - e. Faucet-Hole Location: Top.
  - f. Color: White
  - g. Mounting Material: Chair carrier.
3. Faucet: Automatically Operated Lavatory Faucets
4. Support: Type II, concealed-arm lavatory carrier
5. Lavatory Mounting Height: Standard

B. Lavatory - Ledge Back, Vitreous China, Wall Mounted

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Fixture:
  - a. Standard: ASME A112.19.2/CSA B45.1.
  - b. Type: For wall hanging.
  - c. Nominal Size: Rectangular, 20 by 18 inches.
  - d. Faucet-Hole Punching: Three holes, 4-inch (102-mm) centers.
  - e. Faucet-Hole Location: Top.
  - f. Color: White.
  - g. Mounting Material: Chair carrier.
3. Faucet: Automatically Operated Lavatory Faucets.
4. Support: Type II, concealed-arm lavatory carrier.
5. Lavatory Mounting Height: Standard

2.3 AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Automatic Type: Hardwired Electronic Sensor Operated, Mixing

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Kohler Co.
  - b. Sloan Valve Company.
  - c. Speakman Company.
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Grid Type.

2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  1. NPS 1/2
  2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

## 2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/4
  - 2. Material:
    - a. Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall and chrome-plated, brass or steel wall flange.
    - b. Stainless steel, two-piece trap and swivel elbow with 0.012-inch -(0.30-mm-) thick stainless steel tube to wall, and stainless steel wall flange.

## 2.6 LAVATORY SUPPORTS

- A. Lavatory Carrier:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg Co; a division of Morris Group International.
    - b. Josam Company.
    - c. MIFAB, Inc.
    - d. Zurn Industries, LLC.
  - 2. Standard: ASME A112.6.1M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install lavatories level and plumb in accordance with roughing-in drawings.

- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### 3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.5 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216.13

SAMARITAN'S PURSE PARK  
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## SECTION 22 42 16.16 - COMMERCIAL SINKS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Service sinks.
  - 2. Kitchen/utility sinks.
  - 3. Handwash sinks.
  - 4. Manually operated sink faucets.
  - 5. Automatically operated sink faucets.
  - 6. Supply fittings.
  - 7. Waste fittings.
  - 8. Sink supports.
  - 9. Grout.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.



## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

## PART 2 - PRODUCTS

### 2.1 SERVICE SINKS

- A. Service Sinks - Enameled Cast Iron, Trap Standard Mounted:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kohler Co.
    - b. Zurn Industries, LLC.
  - 2. Source Limitations: Obtain sinks from single source from single manufacturer.
  - 3. Fixture:
    - a. Standard: ASME A112.19.1/CSA B45.2.
    - b. Type: Service sink with back.
    - c. Back: Two faucet holes.
    - d. Nominal Size: 24 by 20 inches.
    - e. Color: White.
    - f. Mounting: NPS 2 P-trap standard with grid strainer inlet, cleanout, and floor flange.
    - g. Rim Guard: On front and sides.
  - 4. Faucet: Manual
- B. Service Sinks - Enameled Cast Iron, Floor Mounted: .
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Zurn Industries, LLC.
  - 2. Source Limitations: Obtain sinks from single source from single manufacturer.
  - 3. Fixture:
    - a. Standard: ASME A112.19.1/CSA B45.2.

- b. Style: With front apron and raised back.
- c. Nominal Size: 28 by 28 inches.
- d. Color: White.
- e. Drain: Grid with NPS 3 outlet.
- f. Rim Guard: Coated wire.

- 4. Faucet: Manual.

## 2.2 KITCHEN/UTILITY SINKS

### A. Kitchen/Utility Sinks - Stainless Steel, Counter Mounted: .

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkay.
  - b. Franke.
  - c. Just Manufacturing.
- 2. Source Limitations: Obtain sinks from single source from single manufacturer.
- 3. Fixture:
  - a. Standard: ASME A112.19.3/CSA B45.4.
  - b. Type: Stainless steel, self-rimming, sound-deadened unit less ledge back.
  - c. Number of Compartments: One Two.
  - d. Overall Dimensions: .
  - e. Material: 18 gauge, Type 304 stainless steel.
  - f. Compartment:
    - 1) Dimensions: 19 x 21.
    - 2) Drain: Grid with NPS 1-1/2 tailpiece and twist drain.
    - 3) Drain Location: Near back of compartment.
    - 4) Depth: Wheelchair accessible.
  - g. Each Compartment:
    - 1) Dimensions: .
    - 2) Drains: Grid with NPS 1-1/2 tailpiece and twist drain.
    - 3) Drain Location: Near back of compartment.
    - 4) Depth: Standard.
- 4. Faucet(s): .
  - a. Number Required: One.
  - b. Mounting: On ledge.
- 5. Supply Fittings:

- a. Standard: ASME A112.18.1/CSA B125.1.
- b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
  - 1) Operation: Wheel handle.
  - 2) Risers: NPS 1/2, chrome-plated, rigid-copper pipe.
- 6. Waste Fittings:
  - a. Standard: ASME A112.18.2/CSA B125.2.
  - b. Trap(s):
    - 1) Size: NPS 1-1/2.
    - 2) Material:
      - a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.
  - c. Continuous Waste:
    - 1) Size: NPS 1-1/2.
    - 2) Material: Chrome-plated, 17-gauge brass tube.
- 7. Mounting: On counter with sealant.

## 2.3 MANUALLY OPERATED SINK FAUCETS

- A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- B. Commercial Sink Faucets - Manual Type: Single-control mixing Two-handle mixing,.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Chicago Faucets; Geberit Company.
    - b. Elkay.
    - c. Just Manufacturing.
    - d. Kohler Co.
    - e. Speakman Company.
    - f. Zurn Industries, LLC.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
5. Body Type: Widespread.
6. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 1.5 gpm.
9. Mounting Type: Deck, exposed.
10. Valve Handle(s): Lever Cross, four arm 4-inch wrist blade.
11. Spout Type: Rigid, Rigid with wall brace.
12. Vacuum Breaker: Required for hose outlet.
13. Spout Outlet: Aerator.

C. Commercial Service Sink Faucets - Manual Type: .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Chicago Faucets; Geberit Company.
  - b. Kohler Co.
  - c. Speakman Company.
  - d. Zurn Industries, LLC.
2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.
4. Faucet:
  - a. Standards:
    - 1) ASME A112.18.1/CSA B125.1.
    - 2) NSF 61 and NSF 372.
    - 3) ICC A117.1.
    - 4) ASSE 1001 (VB).
  - b. Finish: Polished chrome plated.
  - c. Handles: 4-inch wrist blade.
  - d. Cartridges: Ceramic.
  - e. Brace: Adjustable top brace.

## 2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
  - 1. NPS 3/8, NPS 1/2.
  - 2. Chrome-plated, rigid-copper pipe

## 2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2.
  - 2. Material:
    - a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

## 2.6 SINK SUPPORTS

- A. Sink Carrier:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Jay R. Smith Mfg Co; a division of Morris Group International.
    - b. Josam Company.
    - c. Zurn Industries, LLC.
  - 2. Source Limitations: Obtain sink supports from single source from single manufacturer.
  - 3. Standard: ASME A112.6.1M.

## 2.7 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install sinks level and plumb in accordance with rough-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
  - 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve
  - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### 3.3 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### 3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

### 3.5 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Install new batteries in battery-powered, electronic-sensor mechanisms.

### 3.6 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.

- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 4216.16



## SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.

#### 1.03 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.

4. Dates of use.
5. Dates of calibration.

#### 1.05 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
  1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
  2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a TAB technician.
- B. TAB Conference: Meet with Construction Manager on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
  1. Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
  1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect and Construction Manager.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

#### 1.06 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.07 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.01 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one of the following:
  - 1. American Air Balance Company. 4721 E. Hunter Avenue, Anaheim, California 92807
  - 2. Winaire, Inc. 15641 Chemical Lane, Suite A, Huntington Beach, Ca 92649
  - 3. Los Angeles Air Balance Company, Inc. 1848 W. 11<sup>th</sup> #N, Upland, Ca 91786

### 3.02 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 13 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use

tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.03 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 6. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.04 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111 and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," and Section 23 07 19 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.05 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

### 3.06 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.

- b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
  1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.07 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Record observations including name of controller manufacturer, model number, serial number, and nameplate data. Record VFD speed settings, speed limits, programming parameters and set points. SF-1 thru 4 and GEF1-6 are step speed controlled in steps of 33%, 66% and 100%. Confirm that fans properly stage speed steps according to sequence of operation.

### 3.08 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air condenser temperatures.
- C. Record compressor data.

### 3.09 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil (Residential fan coils. Test a random sample consisting of one of each plan type):
  1. Entering- and leaving-water temperature.
  2. Water flow rate.
  3. Water pressure drop.
  4. Dry-bulb temperature of entering and leaving air.
  5. Airflow.
  6. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil (First floor heat pumps. Test each heat pump):
  1. Nameplate data.
  2. Airflow.
  3. Entering- and leaving-air temperature at full load.

4. Voltage and amperage input of each phase at full load and at each incremental stage.
  5. Calculated kilowatt at full load.
  6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each refrigerant coil (residential and common area fan coils. Test each heat pump. Test a random sample of residential units consisting of one of each plan type):
1. Dry-bulb temperature of entering and leaving air.
  2. Wet-bulb temperature of entering and leaving air.
  3. Airflow.
  4. Air pressure drop.
  5. Refrigerant suction pressure and temperature.

### 3.10 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.
  3. Heating-Water Flow Rate: Plus or minus 10 percent.

### 3.11 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
1. Pump curves.
  2. Fan curves.
  3. Manufacturers' test data.



4. Field test reports prepared by system and equipment installers.
  5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
  2. Name and address of the TAB contractor.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Fan drive settings including settings and percentage of maximum pitch diameter.
    - e. VFD settings for garage exhaust and supply fans.
    - f. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Duct, outlet, and inlet sizes.
  3. Position of balancing devices.
- E. Motor Test Reports shall be included with all following test reports
1. Motor data:
    - a. Motor make, model, serial number and size.
    - b. Nameplate Horsepower, RPM, Volts, Phase, Full load Amps, service factor, efficiency and power factor.
  2. Test data
    - a. Watts or kW, Volts, phase, amps and power factor.
    - b. Sheave make, size in inches, and bore.

- c. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- F. Apparatus-Coil Test Reports for residential DX cooling/hot water heating fan coils and first floor heat pump fan coils:
- 1. Coil Data:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in fins per inch o.c.
    - f. Make and model number.
    - g. Face area in sq. ft.
    - h. Tube size in NPS.
    - i. Tube and fin materials.
    - j. Circuiting arrangement.
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Average face velocity in fpm.
    - c. Air pressure drop in inches WG.
    - d. Heat pumps and residential Unit 2C - Outdoor-air, wet- and dry-bulb temperatures in deg F.
    - e. Return-air, wet- and dry-bulb temperatures in deg F.
    - f. Entering-air, wet- and dry-bulb temperatures in deg F.
    - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
    - h. Water flow rate in GPM.
    - i. Water pressure differential in feet of head or psig.
    - j. Entering-water temperature in deg F.
    - k. Leaving-water temperature in deg F.
    - l. Refrigerant expansion valve and refrigerant types.
    - m. Refrigerant suction pressure in psig.
    - n. Refrigerant suction temperature in deg F.
- G. Electric-Coil Test Reports: For electric coils installed in heat pump fan coil units, include the following:
- 1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Coil identification.
    - d. Capacity in Btu/h.
    - e. Number of stages.
    - f. Connected volts, phase, and hertz.
    - g. Rated amperage.
    - h. Air flow rate in cfm.
    - i. Face area in sq. ft.
    - j. Minimum face velocity in fpm.
  - 2. Test Data (Indicated and Actual Values):
    - a. Heat output in Btu/h.
    - b. Air flow rate in cfm.

- c. Air velocity in fpm.
  - d. Entering-air temperature in deg F.
  - e. Leaving-air temperature in deg F.
  - f. Voltage at each connection.
  - g. Amperage for each phase.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
  - 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  - 2. Motor Data described above:
  - 3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches WG.
    - c. Fan rpm.
    - d. Discharge static pressure in inches WG.
    - e. Suction static pressure in inches WG.
    - f. Motor test data
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  - 1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches WG.
    - e. Duct size in inches.
    - f. Duct area in sq. ft.
    - g. Indicated air flow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual air flow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
  - 2. Test Data (Indicated and Actual Values):
    - a. Static head in feet of head or psig.
    - b. Actual impeller size in inches.
    - c. Full-open flow rate in GPM.
    - d. Full-open pressure in feet of head or psig.
    - e. Final discharge pressure in feet of head or psig.
    - f. Final suction pressure in feet of head or psig.
    - g. Final total pressure in feet of head or psig.
    - h. Final water flow rate in GPM.

- i. Voltage at each connection.
- j. Amperage for each phase.

J. Instrument Calibration Reports:

- 1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

### 3.13 INSPECTIONS

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
- 2. Check the following for each system:
  - a. Measure airflow at all supply outlets and exhaust inlets of at least 10 percent of randomly selected residential units. Record which units were tested
  - b. Measure water flow for same units.
  - c. Measure airflow at all air inlets and outlets in first floor spaces
  - d. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - e. Verify that balancing devices are marked with final balance position.
  - f. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

- 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner and engineer.
- 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner and engineer.
- 3. Owner and engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

### 3.14 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION

## SECTION 23 07 13 - DUCT INSULATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
  - 3. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Application: It is intended that this section will apply to ductwork in the first-floor common areas. Contractor may elect to utilize duct board and flexible duct in which case this section would not be applicable.
- C. Related Sections:
  - 1. Section 23 07 19 "HVAC Piping Insulation."

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
  - 1. Sheet Form Insulation Materials: 12 inches square.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

## 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," and "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; Soft Touch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.

### 2.02 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

### 2.03 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.



7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.04 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- B. Wire: 0.062-inch soft-annealed, stainless steel.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of ducts and fittings.
- B. Install insulation materials and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Keep insulation materials dry during application and finishing.
- F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- G. Install insulation with least number of joints practical.
- H. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- I. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- L. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.04 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to lower circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Overlap un-faced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
6. Wire insulation in place. Spacing to prevent insulation from sagging.

### 3.05 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.06 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply, return and outdoor air.
- B. Items Not Insulated:
  1. Fibrous-glass ducts.
  2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  3. Factory-insulated flexible ducts.
  4. Factory-insulated plenums and casings.
  5. Flexible connectors except as noted on plans for acoustical treatment.
  6. Vibration-control devices.
  7. Factory-insulated access panels and doors.

### 3.07 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round supply-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Concealed, round return-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Concealed, rectangular, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Concealed, rectangular, return-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.
- E. Concealed, rectangular, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density

END OF SECTION

## SECTION 23 07 19 - HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
  - 1. Section 23 07 13 "Duct Insulation."

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.
  - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
  - 2. Sheet Form Insulation Materials: 12 inches square.
  - 3. Jacket Materials for Pipe: 12 inches long by NPS 2.
  - 4. Sheet Jacket Materials: 12 inches square.
  - 5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

#### 1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### PART 2 - PRODUCTS

#### 2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000-Degree Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.02 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aero seal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale  
Environmental Chambers."

## 2.03 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

## 2.04 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.



### 3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- N. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements for firestopping and fire-resistive joint sealers as specified.
- D. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements as specified.

### 3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.07 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install preformed pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
  - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

### 3.08 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### 3.09 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of fittings, and three locations of valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Refrigeration liquid lines upstream of expansion valve.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction Flexible Tubing:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.

END OF SECTION

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for ventilation, heating and cooling units not supplied with factory-wired controls.
  - 1. Temperature control of fans
  - 2. Temperature control of residential units
  - 3. Temperature control of common areas

#### 1.03 DEFINITIONS

- A. I/O: Input/output.
- B. PID: Proportional plus integral plus derivative.
- C. RTD: Resistance temperature detector.

#### 1.04 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  - 1. System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, valves, relays/switches.
  - 2. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, and control devices.



3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. System Hardware:
    - a. Wiring diagrams for control units with termination numbers.
    - b. Schematic diagrams and floor plans for field sensors and control hardware.
    - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  7. Controlled Systems:
    - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    - c. Written description of sequence of operation including schematic diagram.
    - d. Points list.
- C. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.
- D. Samples for Verification: For each color required, of each type of thermostat cover.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- B. Qualification Data: For Installer and manufacturer.
- C. Field quality-control test reports.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
  2. Interconnection wiring diagrams with identified and numbered system components and devices.
  3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

#### 1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replacement Materials: One replacement mechanism for each:
    - a. Residential thermostat
    - b. Common area heat pump thermostat
    - c. Line voltage thermostat
    - d. Bath fan motion sensor switch
    - e. Ventilation fan 120 V speed control
    - f.
  - 2. Maintenance Materials: One thermostat adjusting key(s).

#### 1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

#### 1.10 COORDINATION

- A. Coordinate location of thermostats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate supply of conditioned electrical branch circuits for control units and operator interface.
- C. Coordinate equipment with Division 26 to achieve compatibility with starter coils and annunciation devices.
- D. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

### PART 2 - PRODUCTS

#### 2.01 CONTROL SYSTEM

- A. Manufacturers:

1. As noted in sections below.

- B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

## 2.02 THERMOSTATS

- A. Manufacturers:

1. Thermostats, for WIFI application.

- B. Electric, solid-state, microcomputer-based room thermostat with remote sensor.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on each day of week.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:
  - a. Time of day.
  - b. Actual room temperature.
  - c. Programmed temperature.
  - d. Programmed time.
  - e. Duration of timed override.
  - f. Day of week.
  - g. System mode indications include "heating," "off," "fan auto," and "fan on."

- C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

### 3.02 INSTALLATION

- A. Implement all features of programs to specified requirements and as appropriate to sequence of operation.

- B. Connect and configure equipment to achieve sequence of operation specified.
- C. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
- D. Install guards on thermostats in the following locations:
  - 1. Entrances.
  - 2. Public areas.
  - 3. Where indicated.
- E. Install labels and nameplates to identify control components according to Section 23 05 53 "Identification for HVAC Piping and Equipment."

### 3.03 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Install signal and communication cable according to Division 27 Communications.
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install exposed cable in raceway.
  - 3. Install concealed cable in raceway.
  - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
  - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
  - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

### 3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
5. Check temperature instruments and material and length of sensing elements.
6. Check system as follows:
  - a. Verify that controller power supply is from emergency power supply, if applicable.
  - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
  - c. Verify that spare I/O capacity has been provided.
  - d. Verify that controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.05 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.

- e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
  - 5. Flow:
    - a. Adjust flow switches for proper switching set point. Manually operate flow switches to verify that they make or break contact.
  - 6. Temperature:
    - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    - b. Calibrate temperature switches to make or break contacts.
  - 7. Provide diagnostic and test instruments for calibration and adjustment of system.
  - 8. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Adjust initial temperature set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

### 3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 01 79 00 "Demonstration and Training."

END OF SECTION

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## SECTION 23 23 00 - REFRIGERANT PIPING

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

#### 1.03 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 PSIG.
  - 2. Suction Lines for Heat-Pump Applications: 535 PSIG.
  - 3. Hot-Gas and Liquid Lines: 535 PSIG.

#### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for the following:
  - 1. Thermostatic expansion valves.
  - 2. Solenoid valves.
  - 3. Filter dryers.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
  - 1. Shop Drawing Scale: 1/8 inch equals 1 foot.
  - 2. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.



## 1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

## 1.07 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."
- D. Sizing, layout, and components shall comply with air conditioner manufacturer's requirements for "long line" installations.

## 1.08 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

## 1.09 COORDINATION

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 "Roof Accessories."

# PART 2 - PRODUCTS

## 2.01 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

## 2.02 VALVES AND SPECIALTIES

- A. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
  - 1. Body and Bonnet: Plated steel.
  - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  - 3. Seat: Polytetrafluoroethylene.

4. End Connections: Threaded.
  5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
  6. Working Pressure Rating: 400 PSIG.
  7. Maximum Operating Temperature: 240 deg F.
  8. Manual operator.
- B. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  5. Suction Temperature: 40 deg F.
  6. Superheat: Adjustable.
  7. Reverse-flow option (for heat-pump applications).
  8. End Connections: Socket, flare, or threaded union.
  9. Working Pressure Rating: 700 PSIG.
- C. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
  3. Desiccant Media: Activated alumina or charcoal.
  4. Designed for reverse flow (for heat-pump applications).
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 PSIG.
  8. Rated Flow: match air conditioner size.
  9. Working Pressure Rating: 600 PSIG.
  10. Maximum Operating Temperature: 240 deg F.

## 2.03 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Atofina Chemicals, Inc.
  2. DuPont Company; Fluorochemicals Div.
  3. Honeywell, Inc.; Genetron Refrigerants.
  4. INEOS Fluor Americas LLC.
- C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

## PART 3 - EXECUTION

### 3.01 FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

### 3.02 VALVE AND SPECIALTY APPLICATIONS

- A. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- B. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - 1. Install valve so diaphragm case is warmer than bulb.
  - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- C. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

### 3.03 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.

- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install refrigerant piping in protective conduit where installed belowground.
- L. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Traps on vertical risers are not required when compressor is above coil. When compressor is below coil, provide an inverted trap with peak of trap above coil.
  - 4. Liquid lines may be installed level.
- M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- O. Identify refrigerant piping and valves according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."

### 3.04 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

### 3.05 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- D. Support multi-floor vertical runs at least at each floor.

### 3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.

- c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.07 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 PSIG.
  - 4. Charge system with a new filter-dryer core in charging line.
  - 5. Charge system per air conditioner manufacturer's published "long line" guidelines. Charge to a minimum of 10 degrees subcooling or the rating plate subcooling, whichever is greater.

### 3.08 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open compressor suction and discharge valves.
  - 2. Open refrigerant valves except bypass valves that are used for other purposes.
- E. Do not leave R410A suction line filter in line longer than 72 hours.

END OF SECTION

## SECTION 23 31 13 - METAL DUCTS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Duct liner.
  - 5. Sealants and gaskets.
  - 6. Hangers and supports.
  - 7. Seismic-restraint devices.
- B. Related Sections:
  - 1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 23 33 00 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### 1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
  - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
  - 3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
  - a. Lighting fixtures.
  - b. Air outlets and inlets.
  - c. Speakers.
  - d. Sprinklers.
  - e. Access panels.
  - f. Perimeter moldings.

D. Welding certificates.

E. Field quality-control reports.

## 1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.



- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- D. Mockups:
  - 1. Before installing duct systems, build mockups representing static-pressure classes in excess of. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
    - a. transverse joints.
    - b. access door(s).
    - c. typical branch connections, each with at least one elbow.
    - d. typical flexible duct or flexible-connector connections for each duct and apparatus.
    - e. 90-degree turn(s) with turning vanes.
    - f. fire damper(s).
    - g. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Inner Duct: Minimum 0.028-inch.
- G. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Maximum Thermal Conductivity: at 75 deg F mean temperature.
  - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
  - 3. Coat insulation with antimicrobial coating.

4. Cover insulation with polyester film complying with UL 181, Class 1.
- H. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
  1. Maximum Thermal Conductivity: at 75 deg F mean temperature.

## 2.03 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  1. Galvanized Coating Designation.
  2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  1. Galvanized Coating Designation.
  2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick.
  3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.
- D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- G. Factory- or Shop-Applied Antimicrobial Coating:
  1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
  2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
  4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
  5. Shop-Applied Coating Color.
  6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

- H. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- I. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.04 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers: Subject to compliance with requirements:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
    - e. Maximum Thermal Conductivity:
      - 1) Type I, Flexible: at 75 deg F mean temperature.
      - 2) Type II, Rigid: at 75 deg F mean temperature.
  - 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  - 4. -Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
  - 1. Manufacturers: Subject to compliance with requirements:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
    - a. Aeroflex USA Inc.
    - b. Armacell LLC.
    - c. Rubatex International, LLC
  - 3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
  - 4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

- a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
  1. Manufacturers: Subject to compliance with requirements:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
    - a. Bonded Logic, Inc.
    - b. Reflectix Inc.
  3. Maximum Thermal Conductivity: at 75 deg F mean temperature when tested according to ASTM C 518.
  4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
  5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
    - a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Insulation Pins and Washers:
  1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
  1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - a. Fan discharges.
  - b. Intervals of lined duct preceding unlined duct.
  - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
  - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.05 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. **Tape Width.**
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch W.G., positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch WG, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch WG, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
  - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch WG and shall be rated for 10-inch WG static-pressure class, positive or negative.
  - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.06 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## 2.07 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements:
  - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2. Ductmate Industries, Inc.
  - 3. Hilti Corp.
  - 4. Kinetics Noise Control.
  - 5. Loos & Co.; Cableware Division.
  - 6. Mason Industries.
  - 7. TOLCO; a brand of NIBCO INC.



8. Unistrut Corporation; Tyco International, Ltd..
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by.
  1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: -steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## PART 3 - EXECUTION

### 3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### 3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.03 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

- A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease and sloped a minimum of 2 percent to drain grease back to the hood.
- B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.
- C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

### 3.04 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch WG and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch WG: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch WG and Lower: Seal Class C.
  - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch WG: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.05 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.06 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with
  - 1. Space lateral supports a maximum of o.c., and longitudinal supports a maximum of o.c.
  - 2. Brace a change of direction longer than 12 feet.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

### 3.07 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.08 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified.

### 3.09 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
  - a. Ducts with a Pressure Class Higher Than 3-Inch WG: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
  - b. Supply Ducts with a Pressure Class of or Higher: Test representative duct sections totaling no less than percent of total installed duct area for each designated pressure class.
  - c. Return Ducts with a Pressure Class of or Higher: Test representative duct sections totaling no less than percent of total installed duct area for each designated pressure class.
  - d. Exhaust Ducts with a Pressure Class of or Higher: Test representative duct sections totaling no less than percent of total installed duct area for each designated pressure class.
  - e. Outdoor Air Ducts with a Pressure Class of or Higher: Test representative duct sections totaling no less than percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give days' advance notice for testing.

- C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
  - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.10 DUCT CLEANING

- A. Clean duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
  - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 23 33 00 "Duct Accessories" for access panels and doors.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
  - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  - 4. Coils and related components.
  - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  - 6. Supply-air ducts, dampers, actuators, and turning vanes.
  - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
  - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
  - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

### 3.11 START UP

- A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

### 3.12 DUCT SCHEDULE

#### A. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:
  - a. Pressure Class: Positive 2-inch WG.
  - b. Minimum SMACNA Seal Class: B
  - c. SMACNA Leakage Class for Rectangular: 12
  - d. SMACNA Leakage Class for Round and Flat Oval: 12
2. Ducts Connected to Constant-Volume Air-Handling Units:
  - a. Pressure Class: Positive 3 inch WG.
  - b. Minimum SMACNA Seal Class: B
  - c. SMACNA Leakage Class for Rectangular: 12
  - d. SMACNA Leakage Class for Round and Flat Oval: 12
3. Ducts Connected to Equipment Not Listed Above:
  - a. Pressure Class: Positive 3 inch WG.
  - b. Minimum SMACNA Seal Class: B
  - c. SMACNA Leakage Class for Rectangular: 6
  - d. SMACNA Leakage Class for Round and Flat Oval: 6

#### B. Return Ducts:

1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:
  - a. Pressure Class: Positive or negative 2 inch WG.
  - b. Minimum SMACNA Seal Class: B
  - c. SMACNA Leakage Class for Rectangular: 12
  - d. SMACNA Leakage Class for Round and Flat Oval: 12.
2. Ducts Connected to Air-Handling Units:
  - a. Pressure Class: Positive or negative 3 inch WG.
  - b. Minimum SMACNA Seal Class: B
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round and Flat Oval: 12.
3. Ducts Connected to Equipment Not Listed Above:
  - a. Pressure Class: Positive or negative 3 inch WG.
  - b. Minimum SMACNA Seal Class: B

- c. SMACNA Leakage Class for Rectangular: 12
  - d. SMACNA Leakage Class for Round and Flat Oval: 12
- C. Exhaust Ducts:
  - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 3-inch WG.
    - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 12.
- D. Liner:
  - 1. Supply Air Ducts: Flexible elastomeric, 1 inch thick.
  - 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.
  - 3. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- E. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm:
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible,"



Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

- 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
  - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
  - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
  - 4) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, and Larger in Diameter.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

## SECTION 23 34 23 - HVAC POWER VENTILATORS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Residential ceiling-mounted exhaust fan
  - 2. Common area ceiling-mounted exhaust fan
  - 3. Inline exhaust fans
  - 4. Utility set fans
  - 5. Fan wall (Fan Array)
  - 6. Inline Garage Fans

#### 1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Vibration Isolation Base or suspension system Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

#### 1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  1. Roof framing and support members relative to duct penetrations.
  2. Ceiling suspension assembly members.
  3. Size and location of initial access modules for acoustical tile.
  4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

#### 1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fans to include in emergency, operation, and maintenance manuals.

#### 1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Belts: One set(s) for each belt-driven unit.

#### 1.08 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Fans shall comply with UL 705. Fans for use for restaurant kitchen exhaust shall also comply with UL 762.

#### 1.09 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Basis-of-Design Product: Subject to compliance with requirements, and unless noted otherwise, provide product indicated on schedules on drawings.
- B. Identification: Each fan shall bear a permanently affixed manufacturer's nameplate

### 2.02 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

### 2.03 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

### 2.04 RESIDENTIAL CEILING MOUNTED EXHAUST FAN

- A. Fan: Ventilation fan shall be light, and night-light combination and shall be ceiling mount, ENERGY STAR rated type, with variable speed control that shall be built-in with a high/low adjustable delay timer and activated by a wall switch.
- B. Housing:
  - 1. Galvanized, painted
  - 2. 4" and 6" diameter duct adaptor
  - 3. Backdraft damper at fan outlet
  - 4. Expandable extension brackets up to 24"
  - 5. Double hanger bar.
- C. Motor and controls:
  - 1. The motor shall be enclosed with brushless DC motor engineered to run continuously. Power rating shall be 120v/60Hz.
- D. Performance: No less than 80 CFM and no more than <0.3 sone as certified by the Home Ventilating Institute (HVI) at 0.1 static pressure in inches water gauge(w.g.) with no less than 86 CFM and no more than 0.66 sone as certified by HVI at .25 W.G. Power consumption shall be no greater than 7.5 watts at 0.1 W.G. and 13.3 watts at 0.25 W.G. ENERGY STAR rated with efficiency of no less than 10.72 CFM/watt at 0.1 W.G. and less than 6.53 CFM/ watts at 0.25 W.G.

E. Listings:

1. Fan shall be UL and cUL listed for tub/shower enclosure when used with GFCI branch circuit wiring.
2. Fan shall be ASHRAE 62.2, ENERGY STAR IAP, Earth Craft, California Title-24, WA Ventilation Code compliant. Fan shall be used to comply with CAL Green.

F. Light:

1. Light shall be LED, ENERGY STAR qualified of no less than 912 lumens with a life expectancy of no less than 20,000 hours. Night-light feature shall be include containing the model number and individual serial number for future identification.

## 2.05 COMMON AREA CEILING MOUNTED EXHAUST FAN

- A. Fan: Ventilation fan shall be ceiling mounted, ENERGY STAR rated type, with variable speed control that shall be built-in with a high/low adjustable delay timer and activated by a wall switch.
- B. Housing: Fan wheel housing and integral outlet duct collar shall be injection molded from a specially engineered resin exceeding UL requirements for smoke and heat generation. The outlet duct shall have provision for an aluminum backdraft damper with continuous aluminum hinge rod. The inlet box shall be minimum 22-gauge galvanized steel. Motor shall be isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet. A field wiring compartment with disconnect receptacle shall be standard. To accommodate different ceiling thickness, an adjustable pre-punched mounting bracket shall be provided. A white, non-yellowing, high impact styrene injection molded grille shall be provided as standard. Unit shall be designed with provision for field conversion from ceiling to inline. Unit shall be shipped in ISTA Certified Transit Tested Packaging. Wheel shall be centrifugal forward curved type, injection molded of polypropylene resin. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
- C. Motor and controls: Motor shall be permanent split capacitor with permanently lubricated sealed bearings and include impedance or thermal overload protection and disconnect plug. Motor shall be furnished at the specified voltage.
- D. Performance: Refer to schedule on drawings.
- E. Listings: Fan shall be manufactured by an ISO 9001 certified company. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA Certified Ratings Seal for sound and air performance. Select fans are ENERGY STAR® certified products.

## 2.06 INLINE EXHAUST FAN

- A. Fan: Exhaust fan shall be duct mounted, direct driven centrifugal square inline fan.
- B. Housing: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA

Certified Transit Tested Packaging. Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.

- C. Motor and controls: Motor shall be an electronically commutated motor rated for continuous duty and furnished either with internally mounted potentiometer speed controller or with leads for connection to 0-10 VDC external controller.
- D. Performance: Refer to schedule on drawings.
- E. Listings: Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (CSA Standard 113 - M1984). Fan shall bear the AMCA Certified Ratings Seal for Sound and Air Performance. Fan shall be manufactured by an ISO 9001 certified company. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA Certified Ratings Seal for sound and air performance. Select fans are ENERGY STAR® certified products.

## 2.07 UTILITY SET FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Loren Cook Company.
  - 2. Greenheck.
  - 3. Or approved equal.
- B. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
  - 1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
  - 1. Blade Materials: Aluminum.
  - 2. Blade Type: Backward inclined.
  - 3. Spark-Resistant Construction: AMCA 99, Type A.
- D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- E. Shaft Bearings: Pre-lubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L50 of 200,000 hours.
  - 1. Extend grease fitting to accessible location outside of unit.
- F. Belt Drives:
  - 1. Factory mounted, with final alignment and belt adjustment made after installation
  - 2. Service Factor Based on Fan Motor Size: 1.5.
  - 3. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
  - 4. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.

5. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
4. Access Door: Gasketed door in scroll with latch-type handles.
5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
6. Inlet Screens: Removable wire mesh.
7. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
8. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
9. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever of same material as housing.
10. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
11. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

H. Capacities and Characteristics: Refer to schedule on drawings.

2.08 FANWALL (FAN ARRAY)

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Temtrol.
  2. Or approved equal.
- B. The multiple fan array systems shall include multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified class III as required. Class I fans are not acceptable. Fans shall be rated in accordance with and certified by AMCA for performance.
1. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed.
  2. The fan array shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed.
  3. Each fan/motor cube or cell shall include a minimum 10 gauge, G90-coated galvanized steel intake wall, .100 aluminum spun fan inlet funnel, and a 10-gauge G90 galvanized steel motor support plate rail and structure.
  4. All motors shall be standard foot mounted type TEAO selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2. Motors shall be as manufactured by Baldor, Siemens, or Toshiba for use in multiple fan arrays that operate at varying synchronous speeds as driven by an approved VFD.

5. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedule.
  6. Steel cased motors and/or ODP motors are not acceptable.
  7. All motors shall include permanently sealed (L10-400,000 hr) bearings and AEGIS™ shaft grounding to protect the motor bearings from electrical discharge machining due to stray shaft currents. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, exceeding category BV-5, to meet or exceed an equivalent Grade G.55, producing a maximum rotational imbalance of .022" per second peak, filter in (.55mm per second peak, filter in).
  8. Fan and motor assemblies submitted for approval incorporating larger than 22" wheel size and 215T frames size motors shall be balanced in three orthogonal planes to demonstrate compliance with the G.55 requirement with a maximum rotational imbalance of .022" per second peak filter in (.55 mm per second peak, filter in). Copies of the certified balancing reports shall be provided with the unit O&M manuals at the time of shipment. Submittals that do not include a statement of compliance with this requirement will be returned to the contractor without review.
- C. The multiple fan array unit shall provide the specified acoustical performance as scheduled for the unit Exhaust air opening(s).
1. Listed or alternate manufacturers shall provide modeled acoustical performance of the unit for approval. Submitted sound and performance data showing only single fan performance for multiple fan arrays will be returned without review.
  2. Approved alternate or listed manufacturers that do not manufacture their own fans for the specific purpose of use in multiple fan arrays, shall provide a letter guaranteeing performance for flow, pressure, and acoustics at the perimeter boundary of the unit signed by an officer of the OEM fan manufacturer.
  3. The letter from the OEM fan manufacturer must clearly state that the submitted air handling unit perimeter boundary performance in the submitted unit configuration is guaranteed, and that any deficiencies in performance from that as scheduled will be corrected at no cost to the owner. Submittals for listed and alternate manufacturers that do not contain the letter of guarantee as described above will be returned to the contractor disapproved and must be resubmitted for approval.
  4. Any corrective acoustical treatment, added airway tunnel lengths, increased electrical service, and any structural modifications necessary to meet specified and scheduled performance shall be provided at no additional cost to the owner to meet the specified performance criteria.
  5. All proposed corrective actions, when required, must be submitted for approval, and shall include a guarantee of performance, as listed above, at no additional cost to the owner.
- D. The fan array shall consist of multiple fan and motor "cubes" or "cells", spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air way tunnel cross section and components contained therein.
1. In order to assure uniform velocity profile in the unit cross section, the fan cube dimensions must be variable, such that each fan rests in an identically sized cube or cell, and in a spacing that must be such that the submitted array dimensions fill a minimum of 90% of the cross-sectional area of the air way tunnel.
  2. There shall be no blank off plates or "spacers" between adjacent fan columns or rows to position the fans across the air way tunnel.



3. The array shall produce a uniform air flow profile and velocity profile within the airway tunnel of the unit to equal the specified face velocity by +/- 10% when measured at a point 36" from the intake side of the fan array intake plenum wall, and at a distance of 72" from the discharge side of the fan array intake plenum wall.
4. Submittals for units providing less than the scheduled quantity of fans and/or spacing of the fans for multiple fan arrays shall submit CFD modeling of the air flow profile for pre-bid approval that indicates uniform velocity and flow across all internal components without increasing the length of the unit or changing the aspect ratio of the unit casing as designed.

E. Backdraft Damper

1. Each individual cube or cell in the multiple fan arrays shall be provided with an integral backflow prevention device that prohibits recirculation of air in the event a fan or multiple fans become disabled.
2. The system effects for the backflow prevention device(s) shall be included in the criteria for TSP determination for fan selection purposes and shall be indicated as a separate line item SP loss in the submittals.
3. Submitted unit performance that does not indicate allowance for system effects for the backflow prevention device(s) and the system effect for the fan and motor enclosure in which each fan is mounted, will be returned to the contractor disapproved and will need to be resubmitted with all of the requested information included for approval.
4. Backdraft damper performance data that is per AMCA ducted inlet and discharge arrangements will not be accepted. Damper data must be for the specific purpose of preventing backflow in any disabled fan cube and that is mounted directly at the inlet of each fan.
5. Motorized dampers for this purpose are not acceptable. Submitted fan performance data which only reflect published performance for individual fans in AMCA arrangement "A" free inlet and discharge will not be accepted.
6. Manufacturers that do not manufacture the fans being submitted on must provide certified performance data for fans as installed in the unit with backdraft damper effects included. At the sole discretion of the engineer, such performance testing may be witnessed by the engineer and/or the owner's representative.

F. Each fan motor shall be individually wired to a control panel containing a multiple VFDs, up to 3 motors per VFD. Wire sizing shall be determined, and installed, in accordance with applicable NEC standards code requirements. The Fanwall manufacturer shall provide a single communication interface with the BAS and shall coordinate with the controls contractor to make sure that all necessary data points are communicated.

1. At the discretion of the engineer, unit manufacturers that are approved for bidding purposes only, other than the basis of design manufacturer, and that are submitting multiple fan arrays, shall test one or more of the submitted units for flow, pressure, leakage, BHP, and acoustics as submitted and approved, prior to shipment. The testing shall be witnessed by an owner's representative and approved by the engineer prior to shipment of any of the submitted unit equipment. A test report shall be provided for each tested unit and the report shall be included in the O&M manuals for the units.
2. Each fan & motor assembly shall be removable through a 24" wide, free area, access door located on the discharge side of the fan wall array without removing

the fan wheel from the motor. All fan/motor access doors shall open against pressure.

G. Motor Circuit Protection

1. All motors in the Fanwall Array shall be provided with individual motor protection for thermal overload protection. All motor circuit protectors shall be located in starting device enclosure or, if required by design, in a separate enclosure. Motor circuit protector enclosure shall be located and mounted at a minimal distance from motors in the Fanwall Array. Provide remote indication by means of auxiliary contacts wired in series.
2. Remote indication: Current Sensors wired in series.
3. Pilot Lights: Multiple (one per fan) cover mounted pilot lights for local monitoring

H. Fanwall Technology (FWT) With Variable Frequency Drive Control

1. As required by system design, provide a multiple ABB ACH550 Variable Frequency Drive to start and run all motors in the Fanwall Array. Up to 3 fan motors can be connected to one VFD. The Variable Frequency Drive shall be sized accordingly to start and hold up to 3 motors in the Fanwall. Provide individual VFD disconnects and main fused disconnect for the Fanwall electrical panel.

## 2.09 INLINE GARAGE FANS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. FLAKT Group.
2. Or approved equal.

B. Impeller

1. Material: Aluminum (LM6).
2. Blade Design: High Twist, High Efficiency, Aerofoil section blades.
3. Hub Design: Aluminum hub and clamp-plate with integral steel shaft inset to ensure correct motor drive shaft fit. Hub design shall allow for each blade pitch angle to be individually adjusted.
4. Manufacture: All die cast impeller components shall be examined using real time X-ray radiography (in accordance with ASTM E-155) before machining to ensure highest quality.
5. Balance: In accordance with BS 848-7 / ISO 14694, Grade G16 to G6.3, depending on rated motor power.
6. Form of Running: Form B, Airflow through impeller then over the motor (as standard).
7. Impeller location and fixing: Impeller shall be located and fixed to the motor drive shaft by a key and keyway manufactured in accordance with BS 4235:1972. Axial location shall be provided by collar or shoulder on the drive shaft together with a restraining washer and screw, fitted into a tapped hole in the end of the shaft. The screw shall be locked in position.
8. Impeller Design: Impeller shall be designed for uni-directional operation.
9. Aerodynamic design: Fan maximum absorbed power shall be designed to occur within the normal working range (non-overloading characteristic). Low design impeller stress levels shall ensure product life longevity when operated with the published maximum speed limits.

C. Fan and Silencer Casing

1. Material: All sheet components shall be constructed using pre-galvanized sheet steel grade Z2 G275N, guide vane arms shall be constructed from mild steel to BSEN 10111 Grade DD14 then hot dip galvanized after manufacture to BSENISO 1461.
2. Fan and Silencer Design: The inner fan casing shall be constructed from 2mm thick sheet and enclose the entire length of the impeller and motor assembly. The inner silencer face shall be made from 0.7mm thick pre-galvanized perforated sheet which shall be shaped to aerodynamically match the fan casing and integrated bell mouth inlets. The two silencer outer skins shall be octagonal in cross-section, constructed from 1mm thick pre-galvanized sheet steel and designed to be flush mounted together. Silencers shall be each fitted with flat end plates, which shall be pressed from pre-galvanized steel.

D. Motor

1. Type: Fan motors shall be of the totally enclosed, squirrel cage induction, continuous duty variable torque types.
2. Bearings: Either ball or roller type bearing with an L10 design life of at least 20,000 hours when calculated using ISO 281 for rated fan duty.
3. Motor insulation: The minimum insulation standard (for standard temperature fans) shall be Class "F". High temperature fans shall be designed for smoke extraction and have a minimum insulation standard of Class "H". When operating under the most onerous catalogued condition the motor temperature rise shall be in accordance with EN 60034-1, or EN 12101-3 in cases of Emergency High Temperature applications.
4. Motor output ratings: Motor outputs shall be airstream rated (based on insulation class), unless otherwise noted. Performance shall be generally in accordance with BSEN 60034-1.
5. Motor Finish: Aluminum self-finish or cast iron painted to motor manufacturer's specification.
6. Ingress Protection: IP55 with drain plug fitted.
7. Terminal Boxes: All terminal boxes shall have the same level of protection as the motor.
8. Standard Temperature Fans: Fans shall be designed for continuous operation from -40°C to +50 °C, but shall be also suitable for frequent starting down to -20°C. Motor insulation shall be class F.
9. High Temperature (HT) Range: Once off emergency use for either 200°C (F200), 300°C (F300+) or 400°C (F400) for duration of 2 hours in accordance with EN12101-3. Motor insulation shall be class H.
10. Motor Speed Control: Two speed: Pole change (PC) or Dahandler two speed motors shall be reconnected from a single winding via six winding terminals to give two separate pole numbers.
11. Speed Control: All three phase, single speed, motors shall be suitable for inverter control. The inverter shall be switched out (running Direct-On-Line) once the fan is at full speed during High Temperature mode to maintain the HT certification.

E. Performance Data

1. Published fan performance data shall represent what will be achieved when tested to ISO 13350:1999 (or equivalent to AMCA standard 210), and the achieved sound power level when tested to ISO13347-3 (or equivalent to AMCA standard 300).

Acoustic data shall be provided as sound power levels (Lw re: 1 pW (10-12 watts) for each of the eight octave bands (63 Hz to 8kHz).

F. Warranty Period

1. Warranty period for both the fan and motor shall be 2 years from date of dispatch.

G. Bellmouth Inlets

1. Bellmouth Inlets shall be spun from 2mm mild steel in accordance with BSEN 10111 Grade DD14, cropped to match the height of the Jet Thrust Fan and hot dip galvanized to BSENISO 1461 after manufacture.

H. Inlet/Outlet Guard

1. Inlet wire guards shall be fitted. Outlet wire guards shall be provided where requested. Either guard shall be fabricated from mild steel wire and rod as a welded assembly, which is zinc plated after manufacture. Guards shall be manufactured in accordance with BS 848-5 / ISO 12499.

I. Outlet Deflector

1. Outlet deflector vanes shall be fitted instead of an outlet guard. They shall be constructed from pre-galvanized mild steel and mounted to the silencer endplate.

J. Fan Mounting Bracket

1. A-single, centrally located fan mounting bracket shall make fan installation and maintenance easy. To install the fan, one shall first remove the mounting bracket (foot) and any transport feet from the fan, then install the mounting foot in the required position (on the car park ceiling) using the 4 corner bolt holes, then lift the jet Thrust Fan up to mounting bracket and attach it using the 7 bolts (as supplied).

K. Electrical Isolator Switches

1. High temperature isolator switches shall be supplied instead of terminal boxes on Jet Thrust Fans.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install fans level and plumb.
- B. Support or suspend fans with Vibration- and seismic-control devices are specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Secure roof-mounted fans to platforms.
- D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

### 3.02 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

### 3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Verify inlet cone clearance from fan wheel. Adjust to maintain clearance.
  - 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 6. Adjust belt tension.
  - 7. Adjust damper linkages for proper damper operation.
  - 8. Verify lubrication for bearings and other moving parts.
  - 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 10. Disable automatic temperature-control operators, energize motor, and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 11. Shut unit down and reconnect automatic temperature-control operators.
  - 12. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

### 3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

- B. Adjust belt tension.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

## SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section Includes:
  - 1. Rectangular and square ceiling diffusers.
  - 2. Louver face diffusers.
  - 3. Adjustable bar registers and grilles.
  - 4. Fixed face registers and grilles.
  - 5. Linear diffusers.
  - 6. Return filter grilles
- B. Related Sections:
  - 1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.
- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.01 GENERAL

A. Refer to drawings for basis of design products

### 2.02 CEILING DIFFUSER

- A. Rectangular and Square Ceiling Diffusers:
1. Material: Refer to schedule on plan.
  2. Finish: Refer to schedule on plan.
  3. Mounting: Surface or T-bar. Refer to plan
  4. Pattern: Fixed.
  5. Dampers: Refer to plans.

### 2.03 REGISTERS AND GRILLES

- A. Adjustable Bar Register
1. Material: Refer to schedule on plan.
  2. Finish: Refer to schedule on plan.
  3. Face Blade Arrangement: Vertical, individually adjustable spaced 1/2 inch apart.
  4. Core Construction: Integral.
  5. Rear-Blade Arrangement: Horizontal, lever operated parallel blade damper spaced 3/4 inch apart.
  6. Frame: duct size plus 1-3/4" wide.
  7. Mounting: Countersunk screw.
- B. Fixed Face Filter Grille
1. Material: Refer to schedule on plan.
  2. Finish: Refer to schedule on plan.
  3. Face Blade Arrangement: Bar type Horizontal, 45-degree, spaced 1/2 inch apart.
  4. Frame: duct size plus 2-7/8" wide.
  5. Mounting: Countersunk screw.
  6. Hinged at bottom, swing down filter access, two 90 degree turn latches at top.
  7. Frame depth for 1" filter.
  8. Size to match standard filter sizes.



## 2.04 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical.
- C. Ceiling diffusers in lay-in panels shall be provided with 24x24 panels. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.03 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

## END OF SECTION

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

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## SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONING HEAT PUMP UNITS

### PART 1 - GENERAL

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. Section includes split-system air-conditioning heat-pump units consisting of separate evaporator-fan coil and compressor-condenser components.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- D. Samples for Initial Selection: For units with factory-applied color finishes.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning heat pump units to include in emergency, operation, and maintenance manuals.

#### 1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

## 1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

## 1.08 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-In-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: minimum five years from date of Substantial Completion.
    - b. For Parts: five years from date of Substantial Completion.
    - c. For Labor: five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide comparable product by the following. Refer to mechanical drawings schedule.
  - 1. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division. (Outdoor condensing unit model PUZ and indoor fan coil unit PKA). For Cooling only application.
  - 2. YORK (outdoor condensing units model YHE), and Sun Therm (indoor fan coil units, model HEC).
  - 3. Or approved equal.

## 2.02 INDOOR UNITS (See mechanical schedules for unit sizes)

- A. Wall-Mounted or Horizontal-ceiling-mounted, Evaporator-Fan Components:
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
  2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
  3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
  4. Fan: Direct drive, centrifugal.
  5. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
    - b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Enclosure Type: Totally enclosed, fan cooled (TEFC).
    - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    - f. Mount unit-mounted disconnect switches on of unit. If unique characteristics are required for motors in this Section, insert subparagraphs below.
  6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  7. Condensate Drain Pans:
    - a. Fabricated with percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      - 1) Length: Extend drain pan downstream from leaving face.
      - 2) Depth: A minimum of deep.
    - b. Single-wall, -steel sheet.
    - c. Double-wall, -steel sheet with space between walls filled with foam insulation and moisture-tight seal.
    - d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on of pan.
      - 1) Minimum Connection Size: as required by code.
    - e. Pan-Top Surface Coating: Asphaltic waterproofing compound.
  8. Air Filtration Section:
    - a. General Requirements for Air Filtration Section:
      - 1) Comply with NFPA 90A.
      - 2) Minimum Air resistance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
      - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

## 2.03 OUTDOOR UNITS (see mechanical schedule for unit sizes)

### A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 °F.
7. Mounting Base: Polyethylene.

## 2.04 ACCESSORIES

- A. Thermostat: Low voltage with sub-base to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Drain Hose: For condensate.
- E. Additional Monitoring:
  1. Monitor constant and variable motor loads.
  2. Monitor variable-frequency-drive operation.
  3. Monitor economizer cycle.
  4. Monitor cooling load.
  5. Monitor air distribution static pressure and ventilation air volumes.

## 2.05 CAPACITIES AND CHARACTERISTICS

- A. Refer to equipment schedules on mechanical drawings.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

- C. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-In-Place Concrete." Coordinate anchor installation with concrete base.
- D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
- E. Install seismic restraints.
- F. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection (See Section 23 05 48 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- G. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### 3.02 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

### 3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### 3.04 STARTUP SERVICE

- A. Complete installation and startup check according to manufacturer's written instruction.

### 3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Department's maintenance personnel to adjust, operate, and maintain split system air conditioners.

END OF SECTION



## SECTION 03 11 000- SITE CLEARING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing site utilities.
8. Providing temporary erosion and sedimentation control measures.

B. Related Requirements

1. Section 01 50 00 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

#### 1.2 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

### 1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Mt. San Antonio College Project location.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
- B. Topsoil stripping and stockpiling program

### 1.6 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from City and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed trafficways if required by City or authorities having jurisdiction.
- B. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant protection measures are in place.
- C. Tree- and Plant-Protection Zones: Protect according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to City.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

### 3.4 EXISTING UTILITIES

- A. City will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
  2. City will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by City or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify City and utility companies not less than 21 calendar days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without City's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.

### 3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  2. Grind down stumps and remove roots larger than 3 in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
  3. Use only hand methods or air spade for grubbing within protection zones.
  4. Chip removed tree branches and dispose of off-site
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth as determined onsite by contractor
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches

2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

### 3.7 STOCKPILING ROCK

- A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.
- B. Stockpile rock away from excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
  1. Limit height of rock stockpiles to 36 inches.
  2. Do not stockpile rock within protection zones.
  3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.

### 3.8 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off City's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SAMARITAN'S PURSE PARK  
FORMALLY KNOWN AS EL DORADO PARK  
RENOVATIONS  
CITY OF LANCASTER, CA

PUBLIC WORKS PROJECT NO. 24-008

## SECTION 31 20 00 - EARTH MOVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete.
6. Subsurface drainage backfill.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

##### B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation for recording pre-excavation and earth-moving progress.
2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

#### 1.2 UNIT PRICES

- A. Work of this Section is affected by unit prices for earth moving specified in Section 01 22 00 "Unit Prices."
- B. Quantity allowances for earth moving are included in Section 01 21 00 "Allowances."

#### 1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

- C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- D. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- F. Fill: Soil materials used to raise existing grades.
- G. Rock:
  - 1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.
- I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- J. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct pre-excavation conference at Mt. San Antonio College
  - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
    - a. Personnel and equipment needed to make progress and avoid delays.
    - b. Coordination of Work with utility locator service.
    - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
    - d. Extent of trenching by hand or with air spade.
    - e. Field quality control.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
  - 1. Geotextiles.



2. Controlled low-strength material, including design mixture.
3. Geofoam.
4. Warning tapes.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  1. Classification according to ASTM D2487.
  2. Laboratory compaction curve

## 1.7 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

## 1.8 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Do not commence earth-moving operations until temporary site fencing, and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 31 10 00 "Site Clearing" are in place.

# PART 2 - PRODUCTS

## 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

- C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- F. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.
- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.
- H. Sand: ASTM C33/C33M; fine aggregate.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Mirafi HP 570 for bottom reinforcement and Manufacturer recommendation for prefabricated underground drainage structure.
- B. A Minimum 1-ft side to side overlap should be provided for each fabric layer in accordance with project and manufacturer's specifications.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- D. Final subgrade soils should be uniform and non-yielding; non-expanding and well-drained and moisture conditioned before placing concrete.
- E. The upper 2 inches of subgrade soils underneath the slab-on-grade should be comprised of well-drained granular soils such as sands, gravel or crushed aggregate satisfying the ff criteria:
  - 1. Maximum size less than or equal to 1.5 inches
  - 2. Percent passing U.S. # 200 sieve should be less than or equal to 12%
  - 3. Sand equivalent greater than or equal to 30.

### 3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

### 3.3 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. The minimum depth of over-excavation should be 5 ft below ground surface or 3 ft below bottom of proposed shallow foundations.
- C. Over-excavation should extend at least 5 ft laterally beyond limits of footings.
- D. Deeper over-excavation will be needed if soft, yielding soils or fill soils are exposed on the excavation bottom.

### 3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

### 3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
- C. Trench Bottoms:
  1. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
    - a. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
    - b. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.

- c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
- d. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### 3.7 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Authorized additional excavation and replacement material will be paid for according to Contract provisions
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.9 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring, bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.10 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Backfill voids with satisfactory soil while removing shoring and bracing.
- E. Initial Backfill:
  - 1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
    - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Final Backfill:
  - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

### 3.11 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.
- D. All fill, if not specified in soils report should be compacted to at least 90% of the laboratory dry density in accordance with the ASTM Standard D1557 test method.

- E. Subsurface soil surfaces should be scarified to depth of at least 6 inches.
- F. All import fill should be tested and approved by Project Geotechnical Consultant.

### 3.12 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

### 3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials should be placed, mixed, moisture-conditioned and compacted 90% relative compaction in 6-inch to 8-inch lifts and compacted in accordance with project specifications.
- B. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698.
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95% compaction.
  - 3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material as recommended by manufacturer.
- C. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- D. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1-inch
  - 2. Pavements: Plus or minus 1/2-inch

- E. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2-inch

### 3.14 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place per manufacturer's recommendation

### 3.15 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

### 3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  - 2. Determine that fill material classification and maximum lift thickness comply with requirements.
  - 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:



- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

## SECTION 31 50 00- EXCAVATION SUPPORT AND PROTECTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Requirements:
  - 1. Section 01 32 33 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
  - 2. Section 31 20 00 "Earth Moving" for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site.
  - 1. Review geotechnical report.
  - 2. Review existing utilities and subsurface conditions.
  - 3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
  - 4. Review proposed excavations.
  - 5. Review proposed equipment.
  - 6. Review monitoring of excavation support and protection system.
  - 7. Review coordination with waterproofing.
  - 8. Review abandonment or removal of excavation support and protection system.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.
- B. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:

- B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

## 1.5 CLOSEOUT SUBMITTALS

- A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

## 1.6 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
  - 1. Notify Owner no fewer than 2 days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without owner's written permission.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:
  - 1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
  - 2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
  - 3. Compliance with requirements of authorities having jurisdiction.
  - 4. Compliance with utility company requirements.
  - 5. Compliance with railroad requirements.

### 2.2 MATERIALS

- A. Provide materials that are either new or in serviceable condition.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

- 1. Shore, support, and protect utilities encountered.

### 3.2 INSTALLATION - GENERAL

- A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

### 3.3 SOLDIER PILES AND LAGGING (use as necessary)

- A. Install steel soldier piles before starting excavation.
  - 1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
  - 2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.
  - 3. Accurately align exposed faces of flanges to vary not more than 2 inches
- B. Install wood lagging within flanges of soldier piles as excavation proceeds.
  - 1. Trim excavation as required to install lagging.
  - 2. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

### 3.4 SHEET PILING (use as necessary)

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
- B. Accurately place the piling using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.
  - 1. Limit vertical offset of adjacent sheet piling to 60 inches.
  - 2. Accurately align exposed faces of sheet piling to vary not more than 2 inches.
- C. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.5 TIEBACKS (use as necessary)

- A. Drill, install, grout, and tension tiebacks.
- B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
  - 1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
- C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.6 BRACING (use as necessary)

- A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
  - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
  - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
  - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.7 MAINTENANCE

- A. Monitor and maintain excavation support and protection system.
- B. Prevent surface water from entering excavations by grading, dikes, or other means.

- C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

### 3.8 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks regulatory during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.
  - 1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.
  - 2. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

### 3.9 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.
  - 1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
  - 2. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 "Earth Moving."
  - 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 31 50 00

## SECTION 32 12 16 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Standard Specifications for Public Works Construction, 2021 ("Green Book"), including all subsequent addenda and supplements.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Hot-mix asphalt overlay.
  - 2. Cold milling of existing asphalt pavement.
  - 3. Hot-mix asphalt patching.
  - 4. Asphalt surface treatments.

- B. Related Requirements:

- 1. Section 02 41 19 "Selective Demolition" for demolition and removal of existing asphalt pavement.
  - 2. Section 32 13 13 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
  - 3. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Include technical data and tested physical and performance properties.

- 1. Herbicide.
  - 2. Paving geotextile.
  - 3. Joint sealant.

- B. Hot-Mix Asphalt Designs:

- 1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.

- C. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

- 1. Paving Geotextile: 12 by 12 inches (300 by 300 mm) minimum.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For paving-mix manufacturer and testing agency.

- B. Material Certificates:

- 1. Aggregates.
  - 2. Asphalt binder.
  - 3. Asphalt cement.
  - 4. Cutback prime coat.
  - 5. Emulsified asphalt prime coat.
  - 6. Tack coat.
  - 7. Fog seal.
  - 8. Undersealing asphalt.

- C. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction.

- B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.

- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of state or local DOT for asphalt paving work.

- 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

- 1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
  - 2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
  - 3. Slurry Coat: Comply with weather limitations in ASTM D3910.



## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation per latest approved design criteria by California Department of Transportation Pavement Standards Team and Division of Design Office of Pavement Design
- B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material and ASTM D946/D946M for penetration-graded material.
- C. Cutback Prime Coat: ASTM D2027/D2027M, medium-curing cutback asphalt, MC-30 or MC-70
- D. Emulsified Asphalt Prime Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- F. Fog Seal: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
- G. Water: Potable.

## 2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and approved recycled materials from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- C. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.
- D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- E. Joint Sealant: ASTM D6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes as approved by California Department of Transportation
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Base Course: as approved by California Department of Transportation
  - 3. Binder Course: as approved by California Department of Transportation
  - 4. Surface Course: as approved by California Department of Transportation
- B. Emulsified-Asphalt Slurry: ASTM D3910, Type 1

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

### 3.3 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  - 1. Mill to a depth of 1-1/2 inches (38 mm)
  - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
  - 3. Control rate of milling to prevent tearing of existing asphalt course.
  - 4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
  - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
  - 6. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.
  - 7. Handle milled asphalt material in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
  - 8. Keep milled pavement surface free of loose material and dust.
  - 9. Do not allow milled materials to accumulate on-site.

### 3.4 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Placing Two-Course Patch Material: Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted layer of hot-mix asphalt surface course, finished flush with adjacent surfaces.

### 3.5 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
  - 1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm)
  - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
  - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
  - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

### 3.6 SURFACE PREPARATION

- A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
- B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
  - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.
- D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth (0.5 to 1.40 L/sq. m per 25 mm depth). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

- E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
  1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.7 INSTALLATION OF PAVING GEOTEXTILE

- A. Place paving geotextile promptly in accordance with manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).
- B. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

### 3.8 HOT-MIX ASPHALT PLACEMENT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated 3 times the maximum nominal aggregate size.
  2. Place hot-mix asphalt surface course in single lift.
  3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
  4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
  1. After the first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
  2. Complete a section of asphalt base course and binder course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.9 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
  - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.10 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
- D. Following density:
  - 1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
  - 2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.
- E. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

- F. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.11 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:
  - 1. Base Course and Binder Course: Plus or minus 1/2 inch (13 mm).
  - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course and Binder Course: 1/4 inch (6 mm)
  - 2. Surface Course: 1/8 inch (3 mm)
  - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

### 3.12 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.
  - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

### 3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M or AASHTO T 168.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.
    - a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.14 WASTE HANDLING

- A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16



## SECTION 32 13 13 - CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes concrete paving.

1. Apron

- B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 32 13 16 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.

#### 1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.4 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

## 1.5 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
- C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
  - 1. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

### 2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

### 2.3 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
  - 1. Portland Cement: ASTM C150/C150M, portland cement
  - 2. Fly Ash: ASTM C618, Class C or Class F.
  - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
  - 4. Blended Hydraulic Cement: ASTM C595/C595M,
- B. Normal-Weight Aggregates: ASTM C33/C33M

1. Maximum Coarse-Aggregate Size: 1-1/2 inches
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  2. Retarding Admixture: ASTM C494/C494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- E. Water: Potable and complying with ASTM C94/C94M.

## 2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182,
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

## 2.5 RELATED MATERIALS

- A. Joint Fillers: ASTM D8139, semirigid, closed-cell polypropylene foam
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

## 2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with Architect's design sample.
- E. Concrete Mixtures: Normal-weight concrete.
  - 1. Compressive Strength (28 Days): regional typical strength
  - 2. Slump Limit: regional typical requirement

## 2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 INSTALLATION OF STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

- E. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.
- F. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  - 2. Provide tie bars at sides of paving strips where indicated.
  - 3. Butt Joints: Use epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  - 5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
  - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
  - 2. Extend joint fillers full width and depth of joint.
  - 3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
  - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

- 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool .

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float

surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. to provide a uniform, gritty texture.
3. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
4. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.8 SPECIAL FINISHES

- A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
  1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
  2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
  3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
  4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.
- B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch (1.6 mm).
  1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
  2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
  3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
  4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.



- C. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- D. Comply with ACI 306.1 for cold-weather protection.
- E. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- F. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- G. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:
  - 1. Elevation: 3/4 inch (19 mm).
  - 2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
  - 3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/2 inch (13 mm).
  - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
  - 5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).

6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: owner will engage a qualified testing agency to perform tests and inspections.
  1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test to be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- B. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- C. Test results to be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests to contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive

strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- E. t hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency will make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

### 3.11 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

## SECTION 32 13 16 - DECORATIVE CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Colored concrete paving.
2. Stenciled concrete paving.
3. Stained concrete paving.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 32 13 13 "Concrete Paving" for cast-in-place concrete paving with other finishes, curbs and gutters, and stamped detectable warnings.
3. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and other paving or adjacent construction.

#### 1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.
- C. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
  - 1. Decorative Concrete Installer: Minimum 5 years experience in the construction of decorative concrete, and can provide a list of at least three (3) public works projects which included decorative concrete.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Mockups: Build one mockup of each concrete finish to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
  - 2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 48 by 48-inches (1200 by 1200 mm).
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

#### 1.5 Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  - 2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:
  1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## PART 2 - PRODUCTS

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

### 2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  1. Use flexible or uniformly curved forms for curves of a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.
- B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

### 2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420); deformed.

- C. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 (Grade 420) deformed bars; assembled with clips.
- D. Plain-Steel Wire: ASTM A1064/A1064M, as drawn.
- E. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.4 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C150/C150M, white portland cement Type II.
  - 2. Fly Ash: ASTM C618, Class F. The combined weight of fly ash conforming to ASTM C 618 shall not exceed 25% of the total weight of cementitious materials.
- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S , uniformly graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A, colored.
  - 2. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D, colored.
  - 3. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.

- F. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Scofield, a Business Unit of Sika Corporation; Lithochrome.
    - b. Brickform; a division of Solomon Colors.
    - c. Lambert Corporation.
    - d. Solomon Colors Inc.
    - e. Or equal.
- G. Water: Potable and complying with ASTM C94/C94M.

## 2.5 SURFACE COLORING MATERIALS

- A. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
- B. Pigmented Powder Release Agent: Factory-packaged, dry combination of surface-conditioning and dispersing agents interground with color pigments that facilitates release of stamp mats. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
- C. cement.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brickform Antique Release.
    - b. Euclid; Increte Antique Release.
    - c. Scofield, a Business Unit of Sika Corporation; Lithochrome Antiquing Release.
    - d. Or equal.
- D. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation that facilitates release of stamp mats and texture rollers.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brickform; Liquid Release.
    - b. Scofield, a Business Unit of Sika Corporation; Liquid Release BG.
    - c. Superstone; Bubble Gum Liquid Release.
    - d. Or equal.



## 2.6 STENCIL MATERIALS

- A. Stencils: Manufacturer's standard, moisture-resistant paper or reusable plastic stencils, designed for use on plastic concrete.

## 2.7 STAIN MATERIALS

- A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bomanite Co.
    - b. Brickform; a division of Solomon Colors.
    - c. Scofield, a Business Unit of Sika Corporation.
    - d. Stampcrete International, Ltd.
    - e. Or equal.
- B. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bomanite Co.
    - b. Brickform; a division of Solomon Colors.
    - c. Scofield, a Business Unit of Sika Corporation.
    - d. Or equal.

## 2.8 CURING AND SEALING MATERIALS

- A. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C171.
- B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- C. Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, nondissipating, non-yellowing, manufactured for use with colored concrete.
  - 1. Curing compound shall be pigmented type matching color of integrally colored concrete and shall be approved by coloring admixture manufacturer.
  - 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.
  - 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Euclid Chemical Company (The); a subsidiary of RPM International, Inc.; Everclear VOX, or KUREZ DR VOX.
  - b. SpecChem; SpecRez.
  - c. W.R. Meadows, Inc.; 1100.
  - d. Or equal.
- D. Clear Acrylic Sealer, Low-to-Medium Gloss: Manufacturer's standard, waterborne, non-yellowing and UV-resistant, membrane-forming, acrylic copolymer emulsion or epoxy-modified acrylic emulsion, manufactured for colored concrete, containing not less than 15 percent solids by volume.
- E. oncrete, containing not less than 15 percent solids by volume.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bomanite Co.; Ultra Seal 100 VOC.
    - b. H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.; Clarishield Natural Look.
    - c. Scofield, a Business Unit of Sika Corporation; Scofield Selectseal Plus.
    - d. Or equal.

## 2.9 RELATED MATERIALS

- A. Joint Fillers: ASTM D1752, cork or self-expanding cork or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
  - 1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Polyethylene Film: ASTM D4397, 1 mil (0.025 mm) thick, clear.

## 2.10 CONCRETE MIXTURES

- A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.

- B. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash : 25 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture in concrete as required for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- G. Concrete Mixtures: Normal-weight concrete.
  - 1. Compressive Strength (28 Days): 3500 psi (24.1 MPa).

## 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For concrete batches of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.
  1. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 31 20 00 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 INSTALLATION OF STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap to adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  - 2. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 3. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
  - 1. Extend joint fillers full width and depth of joint.
  - 2. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
  - 3. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  - 4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

5. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated on Drawings, or if not indicated, then not to exceed 10 ft. in either direction. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or

side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement and joint devices.

- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

### 3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

### 3.8 INTEGRALLY COLORED CONCRETE FINISH

- A. Integrally Colored Concrete Finish: After final floating, apply the following finish:
  - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

### 3.9 STENCILING

- A. Cut stencils to slab width and lay on wet concrete. Overlap "mortar joint" on trailing edge of each section of stencil onto leading "mortar joint" of previous section.
- B. Trim stencils to fit slab and adjacent patterns.
- C. Slightly embed stencil into concrete by rolling with stencil roller.
- D. Apply pigmented mineral dry-shake hardener materials to concrete surfaces according to manufacturer's written instructions.
- E. Stencil Rolling:
  - 1. Apply pigmented powder release agent, or liquid release agent, according to manufacturer's written instructions prior to applying texture roller to surface of concrete.
  - 2. Perform rolling operation to produce required texture on concrete surface.

- F. Remove stencils when concrete has sufficiently cured to bear weight. Do not leave stencils in concrete overnight.
- G. Remove debris with mechanical blower prior to application of curing compound. If release agent is applied, delay removal of debris for 24 hours, then flood area with low-pressure water hose, wetting release agent, and follow by cleaning surface with pressure washer.

### 3.10 PIGMENTED MINERAL DRY-SHAKE HARDENER APPLICATION

- A. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surfaces according to manufacturer's written instructions and as follows:
  - 1. Uniformly apply dry-shake hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer to match paving color required.
  - 2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
  - 3. After final power floating, apply the following finish:
    - a. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
- B. Pigmented Powder Release Agent: Uniformly distribute onto dry-shake-hardened and still-plastic concrete at a rate of 3 to 4 lb/100 sq. ft. (1.5 to 2 kg/10 sq. m).
- C. Liquid Release Agent: Uniformly mist surface of dry-shake-hardened and still-plastic concrete at a rate of 5 gal/1000 sq. ft. (0.2 L/sq. m).

### 3.11 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.



- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Compound: Apply immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.
- F. thin three hours after initial application. Maintain continuity of coating, and repair damage during curing period.
  - 1. Cure integrally colored concrete with a pigmented curing compound.
  - 2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.
- G. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.
- H. ontinuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.
- I. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

### 3.12 STAINING

- A. Newly placed concrete paving shall be at least 14 days old before staining.
- B. Prepare surfaces according to manufacturer's written instructions and as follows:
  - 1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
  - 2. ace to dry.
    - a. Do not use acidic solutions to clean surfaces.

3. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by grinding, sanding, or abrasive blasting. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
- C. Scoring: Score decorative jointing in paving surfaces 1/2 inch (12.5 mm) deep with diamond blades to match pattern indicated. Rinse until water is clear. Score before staining.
  1. Joint Width: 1/4-inch (6 mm).
- D. Allow paving surface to dry before applying stain. Verify readiness of paving to receive stain according to ASTM D4263 by tightly taping 18-by-18-inch (450-by-450-mm), 4-mil- (0.1-mm-) thick polyethylene sheet to a representative area of paving surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
- E. Reactive Stain: Apply reactive stain to paving surfaces according to manufacturer's written instructions and as follows:
  1. Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
  2. Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.
  3. ntil water is clear. Control, collect, and legally dispose of runoff.
- F. Penetrating Stain: Apply to paving surfaces according to manufacturer's written instructions and as follows:
  1. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
  2. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
  3. Rinse until water is clear. Control, collect, and legally dispose of runoff.

### 3.13 SEALER APPLICATION

- A. Clear Acrylic Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat, using same application methods and rates.
  1. Begin sealing dry surface no sooner than 28 days after concrete placement.

2. Allow stained concrete surfaces to dry before applying sealer.
3. Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

### 3.14 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

1. Elevation: 3/4 inch (19 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/2 inch (13 mm).
4. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
5. Vertical Alignment of Dowels: 1/4 inch (6 mm).
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
7. Joint Spacing: 3 inches (75 mm).
8. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
9. Joint Width: Plus 1/8 inch (3 mm), no minus.

### 3.15 REPAIR AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
- C. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

### 3.16 DECORATIVE CONCRETE PAVING SCHEDULE

- A. Stained Decorative Concrete Paving A21, A27 and A72:
  1. Locations: As indicated on Drawings.

2. Staining Method: Reactive stain.
3. Color: As indicated on Drawings.

END OF SECTION 32 13 16

## SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.
3. Primers.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

#### 1.2 ACTION SUBMITTALS

A. Product Data:

1. Concrete pavement joint sealants.
2. Joint-sealant backer materials.

### PART 2 - PRODUCTS

#### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backer materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

#### 2.2 COLD-APPLIED JOINT SEALANTS

- A. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. W. R. Meadows, Inc.

- b. Or equal.
- B. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. W. R. Meadows, Inc.
    - b. Or equal.
- C. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Pecora Corporation.
    - b. Or equal.

## 2.3 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backers to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of joint-sealant backer materials.
  - 2. Do not stretch, twist, puncture, or tear joint-sealant backer materials.
  - 3. Remove absorbent joint-sealant backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backer material installation, using proven techniques that comply with the following:
  - 1. Place joint sealants so they fully contact joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants in accordance with the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
  - 1. Remove excess joint sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

### 3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.
- C. lants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73



## SECTION 32 14 40.13 - DECORATIVE STONE SURFACING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install decorative stone surfacing.
2. Extent of decorative stone surfacing is shown.
3. Types of products required include the following:
  - a. Decorative Decomposed Granite
  - b. Boulders
  - c. Weed-control barriers.
  - d. Accessories.

##### B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with, or before, the decorative stone surfacing.
2. Notify other contractors in advance of the installation of decorative stone, gravel, boulders to provide other contractors with sufficient time for the installation of items included in their contracts that must be installed with, or before, the decorative stone surfacing.

#### 1.2 REFERENCES

##### A. Standards listed in this Section are listed below:

1. American Society for Testing and Materials, (ASTM).
  - a. ASTM B 221, Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
  - b. Steel edging.

#### 1.3 ACTION SUBMITTALS

##### A. Samples: Submit the following:

1. Selection of actual decorative granite, cobble, pebble, boulders and stone available from the Supplier in individual, small polyethylene bags, for final selection by Owner's Representative.
2. Make available, for inspection and approval prior to placement of the material, a representative sample selected by Owner's Representative, from the approved supply source.
3. 12-inch square section of weed-control barrier.

B. Certificates: Submit the following:

1. For standard products, submit data certifying that materials comply with specified requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. DG, Pebble, Gravel & Cobble Mulch

1. Site element, diameter and finish/color per plans.

B. Weed-Control Barriers:

1. Composite Fabric: Woven, needle punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8-ounces per square yard, minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine subgrade, verify the elevations, observe the conditions under which Work is to be performed, and notify Owner's Representative, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Owner's Representative.

3.2 PREPARATION

- A. Outline areas to receive decorative stone surfacing and secure Owner's Representative's acceptance before start of Work. Make minor adjustments as may be requested.

3.3 INSTALLATION OF DECORATIVE STONE SURFACING

- A. Rake, level and smooth subgrade so that it is free from all stones, construction debris and other foreign material.
- B. Compact subgrade to 95 percent compaction where there are not plants, and 85% compaction where there are plants.
- C. Place weed-control barrier prior to placing all gravel, dg, boulders, pebble or rock.
1. Lap joints 6-inches, minimum. Secure in place with U pins.
  2. Punch holes 24-inches on centers to allow for drainage.

- 3. Take precautions not to tear or puncture weed-control barrier further when placing decorative stone.
- D. Place decorative stone 2-inches deep to established lines and grades, as indicated on drawings.

#### 3.4 FIELD QUALITY CONTROL

- A. When the decorative stone surfacing and boulder installation is completed, including repair and cleaning, Owner's Representative will make an inspection to determine acceptability.
- B. Where inspected decorative stone surfacing does not comply with the requirements, replace rejected Work and continue specified repair and cleaning until re-inspected by Owner's Representative and found to be acceptable.

#### 3.5 CLEANING AND REPAIR

- A. Repair all erosion channels that may form until time of Substantial Completion.
- B. Keep decorative stone surfacing free of all foreign materials including, but not limited to, soil, debris and weeds until time of Substantial Completion.

END OF SECTION 32 14 40.13

## SECTION 32 17 13 - PARKING BUMPERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Precast concrete wheel stops.

#### 1.2 ACTION SUBMITTALS

- A. Product Data:
  - 1. Precast concrete wheel stops.

### PART 2 - PRODUCTS

#### 2.1 PARKING BUMPERS

- A. Precast Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete; 4000-psi (27.6-MPa) minimum compressive strength; manufacturer's standard height and width by 72 inches (1800 mm) long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
  - 1. Source Limitations: Obtain wheel stops from single source from single manufacturer.
  - 2. Surface Appearance: Smooth, free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
  - 3. Surface Sealer: Manufacturer's standard salt-resistant, clear sealer, applied at precasting location.
  - 4. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch (13-mm) diameter, 14-inch (350-mm) minimum length hardware as standard with wheel-stop manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation in accordance with manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wheel stops in accordance with manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring to substrate.
- C. Securely anchor wheel stops to substrate with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

END OF SECTION 32 17 13

## SECTION 32 17 23 - PAVEMENT MARKINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

B. Related Requirements:

1. Section 09 91 13 "Exterior Painting" for painting exterior concrete surfaces other than pavement markings.
2. Section 09 91 23 "Interior Painting" for painting interior concrete surfaces other than pavement markings.

#### 1.2 ACTION SUBMITTALS

A. Product Data: Include technical data and tested physical and performance properties.

1. Pavement-marking paint, acrylic.

#### 1.3 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

### PART 2 - PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aexcel; Fast Dry Traffic Paint.
2. Diamond Vogel Paint Company; Traffic Paint, Federal Waterborne, Fast Dry.
3. Ennis-Flint, Inc. (PPG Industries); Ennis-Flint Traffic Paint, EF Series Fast Dry Waterborne Paint.
4. Or equal.

- B. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and CBC Chapter 11B, the more stringent requirement shall take precedence.

## 2.3 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint, Acrylic: Ready-mixed, one-component, waterborne acrylic traffic line paint which can be applied to either asphalt concrete or portland cement concrete pavements in conformance with California Department of Transportation Specification PTWB-01R2 for Rapid Dry Waterborne Traffic Line, White, Yellow, and Black.
  - 1. Color: As indicated.
- B. Pavement Legends and Markings shall be Thermoplastic. Thermoplastic material shall be lead free alkyd-based type per Caltrans Standard Specification PTH-02ALKYD. The glass beads shall conform to the requirements of Caltrans Standard Specification 8010-004.
  - 1. The thermoplastic material shall be applied by extrusion method.
  - 2. Pavement marking stencils shall be current Caltrans Standard Plans.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### 3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.

- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23



## SECTION 32 17 26 - TACTILE WARNING SURFACING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Cast-in-place detectable warning tiles.

B. Related Requirements:

1. Section 32 13 13 "Concrete Paving" for concrete walkways serving as substrates for tactile warning surfacing.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.3 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Deterioration of finishes beyond normal weathering and wear.
  - b. Separation or delamination of materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 TACTILE WARNING SURFACING, GENERAL

- A. Accessibility Requirements: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" and California Building Code, Chapter 11B, the more stringent shall apply.

1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.

- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.
- C. Regional Materials: Products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- D. Regional Materials: Products shall be manufactured within 500 miles (800 km) of Project site.
- E. Source Limitations: Obtain each type of tactile warning surfacing from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

## 2.2 DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles with replaceable surface configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Access Tile; products that are compliant with City of Lancaster Standards.
    - b. ADA Solutions; products that are compliant with City of Lancaster Standards.
    - c. Armor Cast; products that are compliant with City of Lancaster Standards.
    - d. Armor-Tile; products that are compliant with City of Lancaster Standards.
    - e. Or equal.
  - 2. Material: Cast-fiber-reinforced polymer concrete tile.
  - 3. Color: Safety yellow.
  - 4. Shapes and Sizes:
    - a. Rectangular panel, 24 by 24 inches (610 by 610 mm) .
  - 5. Dome Spacing and Configuration: Manufacturer's standard compliant spacing , in manufacturer's standard pattern.
  - 6. Mounting:
    - a. Replaceable detectable warning tile wet-set into freshly poured concrete and surface-fastened to permanently embedded anchors.

## 2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:

1. Furnish Type 316 stainless-steel fasteners for exterior use.
  2. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.
- B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.
- C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated. Comply with location requirements of AASHTO MP 12.

#### 3.3 INSTALLATION OF DETECTABLE WARNING TILES

- A. Cast-in-Place Detectable Warning Tiles:
1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
  2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
  3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch (3 mm) from flush.
  4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.

5. Clean tiles using methods recommended in writing by manufacturer.

B. Removable Cast-in-Place Detectable Warning Tiles:

1. Concrete Paving Installation: Comply with installation requirements in Section 321313 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of removable tile.
2. Set each detectable warning tile accurately and firmly in place with embedding anchors and fasteners attached, and firmly seat tile back in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
3. contact with concrete.
4. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8 inch (3 mm) from flush.
5. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
6. Clean tiles using methods recommended in writing by manufacturer.

3.4 CLEANING AND PROTECTION

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by Architect. Replace using tactile warning surfacing installation methods acceptable to Architect.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 32 17 26

## SECTION 32 33 00 - SITE FURNISHINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Seating (Benches).
2. Tables, including accessible units.
3. Bicycle racks.
4. Trash receptacles.
5. Ash receptacles.
6. Pedestal Grill, including accessible units.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing pipe sleeves cast in concrete footings.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For site furnishings.

### PART 2 - PRODUCTS

#### 2.1 SEATING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Northgate (Basis of Design).
  2. Leisure Craft, Inc.
  3. Or equal.
- B. Product: As indicated on Drawings.
- C. Frame: Cast Aluminum.
- D. Seat and Back:

1. Material:
  - a. Aluminum Sheet: Perforated metal.
  - b. Painted Steel: Perforated metal.
  - c. Stainless Steel: Perforated metal.
- E. Steel Finish: Galvanized and powder coat finish.
  1. Color: As selected by Architect from manufacturer's full range.
- F. Stainless Steel Finish: ASTM A480, No. 6.

## 2.2 TABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Northgate (Basis of Design).
  2. Leisure Craft, Inc.
  3. Or equal.
- B. Product: As indicated on Drawings.
- C. Frame: Cast Aluminum.
- D. Table Top:
  1. Material:
    - a. Aluminum Sheet: Perforated metal.
    - b. Painted Steel: Perforated metal.
    - c. Stainless Steel: Perforated metal.
  2. Surface Shape: rectangular.
- E. Aluminum Finish: Color coated.
  1. As indicated by manufacturer's designation.
- F. Steel Finish: Galvanized and powder coat finish.
  1. Color: As selected by Architect from manufacturer's full range.
- G. Stainless Steel Finish: ASTM A480, No. 6.

## 2.3 BICYCLE RACKS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Landscape Forms.
2. Or equal.

B. Product: As indicated.

C. Material: Steel tube with welded base plates and pre-drilled holes.

D. Aluminum Finish: Color coated.

1. As indicated by manufacturer's designation.

E. Steel Finish: Galvanized and powder coat finish.

1. Color: As selected by Architect from manufacturer's full range.

F. Stainless Steel Finish: ASTM A480, No. 6.

## 2.4 TRASH RECEPTACLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Northgate (Basis of Design).
2. Leisure Craft, Inc.
3. Or equal.

B. Product: As indicated on Drawings.

C. Aluminum Facing Surrounds: Match benches.

D. Steel Facing Surrounds: Match benches.

E. Stainless Steel Facing Surrounds: Match benches.

F. Support Frames: Steel; welded.

G. Aluminum Finish: Color coated.

1. As indicated by manufacturer's designation.

H. Steel Finish: Galvanized and powder coat finish.

1. Color: As indicated by manufacturer's designation.

I. Stainless Steel Finish: ASTM A480, No. 6.

J. Graphics: Surface-applied copy, content, and style according to manufacturer's standard.

1. Copy: Recycle.

## 2.5 PEDESTAL GRILL ADA

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Kay Park Recreation.
  2. Or equal.
- B. Product: As indicated on Drawings.
- C. Material: Steel grill body with 2-3/8-inch o.d. galvanized steel pipe pedestal.
- D. Steel Finish: Factory heat resistant paint finish.
  1. Color: As selected by Architect from manufacturer's full range.

## 2.6 ASH RECEPTACLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Kay Park Recreation.
  2. Or equal.
- B. Product: As indicated on Drawings.
- C. Material: Steel slats with cast iron legs.
- D. Steel Finish: Galvanized and thermoplastic coated finish.
  1. Color: As selected by Architect from manufacturer's full range.

## 2.7 MATERIALS

- A. Steel and Iron: Free of surface blemishes and complying with the following:
  1. Plates, Shapes, and Bars: ASTM A36/A36M.
  2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
  3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
  4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.



5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.
6. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended by fabricator for type of use intended.

B. Stainless Steel: Free of surface blemishes and complying with the following:

1. Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M or ASTM A666.
2. Pipe: Schedule 40 steel pipe complying with ASTM A312/A312M.
3. Tubing: ASTM A554.

C. Anchors, Fasteners, Fittings, and Hardware: Stainless steel.

## 2.8 FABRICATION

- A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
- B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
- C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- D. ion of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
- F. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

## 2.9 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.10 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.
- B. Thermoplastic Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, sprayed-on, polyethylene finish, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

## 2.11 IRON FINISHES

- A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

## 2.12 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
  - 1. Run directional finishes with long dimension of each piece.
  - 2. Directional Satin Finish: ASTM A480/A480M, No 4.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION 32 33 00

## SECTION 32 84 00 - PLANTING IRRIGATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The irrigation system will deliver potable water. The existing irrigation system serving the existing site is to be modified to serve this new landscaping. Work includes:
  - 1. Trenching, stockpiling excavation materials, and refilling trenches.
  - 2. Adapted existing system including but not limited to piping, remote control valve and filter assembly, fittings, wiring and final adjustments to ensure complete coverage. The existing system back flow preventer, controller, meter, master valve and filter shall be verified and tested for operation.
  - 3. Transition from PVC to steel pipe when distribution lines are daylight.
  - 4. Coordination of installation of sleeves by other trades for irrigation piping and remote control valves where indicated.
  - 5. Connection to controller.
  - 6. Replacement of unsatisfactory materials.
  - 7. Clean-up, inspection, tests and approval.
- B. Related Requirements:
  - 1. Electrical: Division 26.
- C. References:
  - 1. Perform work in accordance with requirements of Conditions of the Contract and Division 00 – Procurement and Contracting Requirements as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.
  - 2. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in contract documents.
  - 3. American Society for Testing and Materials (ASTM). Specifications and test methods specifically referenced in this section.
  - 4. Underwriters Laboratories (UL) - UL Wires and Cables.
- D. Description: Irrigation lines shown on the Drawings are essentially diagrammatic. Locations of all equipment, heads, valves, piping, wiring, etc., shall be established by Contractor at time of construction.
- E. Coordination: Locate irrigation pipelines in coordination with existing subsoil conditions and as approved by Owner's representative to minimize potential settlement differential.

## 1.2 SUBMITTALS

- A. Prepare and make submittals in accordance with Section 013300, Submittal Procedures.
- B. Submit shop drawings if noted on construction drawings. Include a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate details to accurately portray intent of construction.
- C. Furnish required copies of manufacturer's literature, certifications, and operating instructions for the complete list of materials needed for installation of irrigation system.
- D. Record Irrigation Drawings: Contractor shall furnish Record Drawings of the complete irrigation system in accordance with the General and Special Conditions. Procure from the Landscape Architect full-sized copies of Contract Drawings. These Drawings shall be on the Site at all times while the irrigation system is being installed. Make a daily record of Work installed each day. Actual location of valves and irrigation and drainage piping shall be shown by dimensions from easily identified permanent features, such as buildings, curbs, fences, walks, or property lines. Show approved substitutions (if any) of material, including manufacturer's name and catalogue number. Noted information shall be recorded in a neat, orderly way. Record sepias shall be turned over to Architect at, or before, the Final Acceptance of the Project.
- E. ures, such as buildings, curbs, fences, walks, or property lines. Show approved substitutions (if any) of material, including manufacturer's name and catalogue number. Noted information shall be recorded in a neat, orderly way. Record sepias shall be turned over to Architect at, or before, the Final Acceptance of the Project.
- F. Consultant will not certify any pay request submitted by the contractor if the as-built drawings are not current, and processing of pay request will not occur until as-builts are updated.
- G. dated.
- H. Submit 3 written operating instructions, including maintenance procedures and start-up, with cut sheets of projects, and coordinate controller/watering operation instruction with owner maintenance personnel.
- I. Controller Charts:
  - 1. Do not prepare charts until record ("as-built") drawings have been reviewed by consultant.
  - 2. Provide one controller chart for each automated controller installed.
  - 3. Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.

4. Chart shall be blueline print of actual "as-built" system, showing area covered by that controller.
5. Identify area of coverage of each remote control valve, using a distinctly different pastel color, drawing over entire area of coverage.
6. Following review of charts by consultant, they shall be hermetically sealed between two layers of 20 mm thick plastic sheet.
7. Charts shall be completed and reviewed prior to final review of irrigation system.
8. Attach approved chart to inside of appropriate controller door.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specified type(s) in a neat, orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this project, and financial stability, submit, prior to contract award the following:
  1. List of 3 projects completed in the last 2 years of similar complexity to this project. Description of project shall include: name of projects; location; owner; and, brief description of work and project budget.
- B. Design Changes: No consideration will be given to any design changes until after the Award of Contract. Should any changes be deemed necessary after Award of Contract, for proper installation and operation of the system, such changes will be reviewed and acceptance determined by Landscape Architect.
- C. Requirements of Regulatory Agencies:
  1. All Work and materials shall be in full accordance with latest rules and regulations of safety orders of Division of Industrial Safety, the Uniform Plumbing Code, and other applicable laws or regulations, including the City of San Diego Plumbing Code.
  2. Should the Contract Documents be at variance with regulatory requirements, notify Landscape Architect and receive instructions before proceeding with Work affected.
- D. Testing:
  1. Preliminary review of completed installation will be made by Landscape Architect prior to backfilling of trenches and during hydrostatic testing.
  2. Final review will be made in conjunction with the final review of garden, shrub, and tree planting.
- E. Special Requirements:
  1. Tolerances - specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment,

- refilling, recompaction, and repair of finish grade treatment by contractor at no additional cost to owner.
2. Coordination with other contracts and trades - protect, maintain, and coordinate work with work under other sections.
  3. Damage to other improvements - Contractor shall replace or repair damage to curbing, landscape, grading, soil preparation, seeding, or planting done under other sections during work associated with installation of irrigations system at no additional cost to owner.
  4. Pre-construction conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the work. Conference shall be scheduled no less than 10 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of work to attend conference, including but not limited to landscape architect, contractor's superintendent, and installer.
  5. Minutes of conference shall be recorded and distributed by contractor to all parties in attendance within 10 days of conference.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, waterproof condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, temperature extremes, fire, or jobsite damage. Do not store PVC pipe in direct sunlight.
- B. r, temperature extremes, fire, or jobsite damage. Do not store PVC pipe in direct sunlight.
- C. Exercise care in handling, loading and storing of PVC pipe. All PVC pipe shall be transported in a vehicle which allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and, if installed, shall be replaced with new piping.

#### 1.5 JOBSITE CONDITIONS

- A. Protection of Property:
  1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to work of this section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to

satisfaction of owner, and all injury to living plants shall be repaired by owner. All costs of such repairs shall be charged to and paid by contractor.

2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete or other building material surfaces shall be repaired or replaced at no cost to owner. Restore disturbed areas to original condition.
3. or other building material surfaces shall be repaired or replaced at no cost to owner. Restore disturbed areas to original condition.

B. Protection and Repair of Underground Lines:

1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, sewer, water, and telephone lines. Take whatever precautions are necessary to protect these underground lines from damage, and, in the event damage does occur, all damage shall be repaired by owner. All costs of such repairs shall be paid by contractor unless other arrangements have been made.
2. Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.

1.6 WARRANTY

- A. Manufacturer shall warrant materials against defects for a period of two (2) years from date of substantial completion. Installer(s) shall guaranty workmanship for similar period.
- B. Settling of backfilled trenches which may occur during guaranty period shall be repaired at no expense to owner, including complete restoration of asphalt paving or damaged property.
- C. Expenses due to vandalism before substantial completion shall be borne by contractor.
- D. Owner will maintain planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.7 MAINTENANCE

- A. Furnish the following maintenance items to owner prior to final acceptance:
  1. Two sets of special tools required for removing, disassembling, and adjusting each type of valve supplied on this project.
  2. Two 6-foot valve keys for operation of gate valves (if applicable).
  3. Two keys for each automatic controller cabinet.



## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Materials throughout the system shall be as specified and/or noted on the Drawings, new, and in perfect condition.
- B. Water Meter: Water stub-out is provided under Division 22, Plumbing 220000.
- C. Piping:
  - 1. Piping on Pressure Side of Irrigation Control Valves: Diameter as shown on plans, polyvinyl chloride (PVC) Schedule 40.
  - 2. Piping on Nonpressure Side of Irrigation Control Valves: PVC Schedule 40. Sleeving shall be schedule 40 PVC sized per plans. All sleeves shall extend 12" beyond paved areas. Sleeve installation shall be coordinated with paving and hardscape operations.
  - 3. Piping in architectural walls shall be galvanized steel schedule 40. Transition from PVC to steel to PVC per plan details.
  - 4. Identification: All piping shall be continuously and permanently marked with manufacturer's name or trademark, size, schedule, and type of pipe, working pressure at 73 degrees F, and National Sanitation Foundation (NSF) approval.
- D. Fittings for Solvent-Welded Pipe: Schedule 40 PVC, Standard Weight: As manufactured by Sloane or Lasco, conforming to ASTM D 2466-73 and D 2467-73.
- E. Polyethylene Pipe Fittings: Molded CPVC compression type designed and sized for specific type of pipe by Pepco. Male barb type fittings are not permitted.
- F. Fittings for Swing Joints: (if applicable) Per irrigation materials list.
  - 1. Elbows: Schedule 40 Marlex elbows.
  - 2. Threaded PVC Nipples: Schedule 80 PVC.
- G. Gate Valves: Per plans.
  - 1. Gate Valves 2 inches and smaller shall be bronze Class 125.
  - 2. Ball Valves shall be fully ported bronze valves.
- H. Irrigation Controllers and Master Valves:
  - 1. Inside Mechanical Room. WeatherTRAK ET Pro3 (CWM) conventional – Controller - SA01-WT3-24-AX GT HYDP WTPRO03-24 All Inclusive CWM Sat Assy 1 6, 156.296 6, 156.30 with ET Pro3 (SPH) enclosure -3100200 Superior Master Valve 3100 Brass 2 in. Normally Open FIPT x FIPT 1 274.599 274.60 -QS200-20 GPI Flomec QS200 Ultrasonic Flow Meter in 2 in. PVC Tee s X S 1 404.164.404.16.
  - 2. North Outside Controller. WeatherTRAK ET Pro3 (CWM) conventional – Controller - SA1-WT3-24-AX GT HYDP WTPRO3-24-All Inclusive 18SS Sat Assy 1 8, 707.776 8,

707.78 with ET Prow3 (SPT) enclosure -3100300 Superior Master Valve 3100 Brass 3 in. Normally Open FIPT x FIPT 1 1,267.564 1,267.56 -QS200-30 GPI Flomec QS200 Ultrasonic Flow Meter in 3 in. PVC Tee s X S 1 510.523 510.52.

ET Pro3 Conventional

Electrical & Enclosure Specifications

Input Power:	120 VAC $\pm$ 10%, (60 Hz) or 220 VAC $\pm$ 10%, (60 Hz)
Output Power:	24 VAC (60 Hz), 1.0 Amp (1000mA) maximum per station output including a pump start 1.0 Amp (1000mA) maximum per master valve output 3.0 Amps (80 VA) total load up to 17 terminal outputs energized simultaneously (8 stations, 1 manual, 4 pump starts, 4 master valves)
Consumptive Power:	Idle State: 2.5 Watts Power. Maximum Power Requirements for Irrigation State: 70 Watts.
Certifications:	EPA WaterSense Approved, FCC Certified, UL Listed, 100% SWAT-tested.
Enclosure Options:	Wall Mount Enclosures, 16 gauge wall mount enclosure available in stainless steel and powder coated finishes. Key-hole mounting for wall mount enclosure for easy installation. Easily adapts to a small 14 gauge pedestal, available in two finishes. VIT Strong Box Stainless Steel Pedestal Enclosure Retrofit Chassis for Existing Enclosures. All come with key lock entry, NEMA 3R weather-resistant

I. Master Valve and Flow Sensor

1. Unless waived by the Project Manager, project shall have master valves and flow sensors.
2. Master valves and flow sensors shall be fully compatible with the Irrigation Controller.
3. Master valves and flow sensors shall be sized and installed in strict accordance with manufacturers' recommendations. Specific care shall be taken to properly provide required distances of straight runs of pipe and to minimize excessive runs of reduced mainline sizes. Sensors shall be sized to accurately read flows within the range of design flows. Where large and small flow rates occur on the same project and one size of master valve and flow sensor is not capable of proper function throughout the range, separate master valves and flow sensors shall be provided for the differing ranges of flow.
4. , separate master valves and flow sensors shall be provided for the differing ranges of flow.
5. Wiring between the Master Valves and Flow Sensors shall be as recommended by the manufacturers. The wiring shall be installed in plastic Sch. 40 PVC electrical conduit no less than 1 inch in size. All electrical connections at the Flow Sensor / Master Valve shall be completely sealed using a two part epoxy such as 3M or pentite system. Pre-jelled fittings are not acceptable. Splices between the devices and controllers are not allowed without pre-approval in writing by the Project Manager.

J. Remote Control Valves: Per plans.

1. Remote Control Valves shall be sized based on manufacturer's recommendations.
  2. Pressure regulating modules may be used to regulate pressure for spray head zones where required for proper operation.
- K. Control Wire: Solid copper wire, UL approved for direct burial in ground. Minimum gauge shall be 14 UF. (12 UF for runs over 1,000 LF.) Common ground wire shall be white. Master valve control wire shall be blue. Moisture sensor control wire to be orange.
1. Splicing Materials: Scotchlock spring connectors. Scotchlock No. 3576 Sealing Pack, or approved equal.
- L. Valve Boxes:
1. Concrete valve boxes with cast iron lids. Box shall provide adequate clearance to operate and service valve. Valve box covers must have a stenciled 2" diameter purple dot, to indicate reclaimed use.
  2. Valve boxes of other material to be tan. Lid must have stenciled 2" diameter purple dot, to indicate reclaimed use.
  3. All valve boxes are to have all openings sealed with approved geotextile fabric.
  4. Where valve boxes are to be installed in areas of vehicular traffic, traffic rated boxes shall be used.
- M. Sand Backfill: Clean masonry sand free of stones or debris. ASTM C 144.
- N. Conduits: 4 inches Schedule 40 PVC unless otherwise shown or noted.
- O. Distribution Tubing: 3/16-inch Pepco plus tubing P-185.
- P. Filters: Per plans.
- Q. Mainline Pipe and Fittings:
1. Mainline Piping less than 3 inches in size shall be Sch. 40 PVC with solvent weld joints.
  2. Fittings shall be Sch. 80 PVC for fittings less than 3 inches in size.
  3. Purple pipe shall be used for reclaimed water.
- R. Fittings: Compression type. Use standard PVC fittings with Pepco adapter as required.
- S. Copper Pipe and Fittings:
1. All copper piping shall be Type K rigid conforming to ASTM Standard B88 unless otherwise approved by the Project Manager for special applications.
  2. Galvanized piping and fittings shall not be used.

- T. End Cap: Automatic flushing, compression end plug.
- U. Spray Heads: Per plans.
- V. Landscape Drip Line: Per plans.
- W. Pressure Regulator: Per plans.
- X. Quick Couplers: Per plan.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Layout and Staking: Layout work as accurately as possible to Drawings. Stake out location of each run of pipe, pressure regulator and valves locations prior to trenching. Before installation is started in a given area, Landscape Architect will review locations. Provide 48 hour minimum advance notice to Landscape Architect.
- B. Full and complete coverage is required. Make any necessary minor adjustments required to achieve full coverage of irrigated areas at no additional cost to Owner.
- C. Where connections to existing stub-outs are required, make necessary adjustments should stubs be located differently on Drawings. Adjust layout as necessary to install around existing work.
- D. Where piping is shown to be under paved areas but running parallel and adjacent to planted area, install piping in planted areas.
- E. Pipe sizes shall conform to those shown on the Drawings. Substitution of smaller pipe sizes is not permitted but substitution of larger sizes may be accepted. Pipe damaged or rejected because of defects shall be removed from the Site at the time of said rejection.

#### 3.2 INSTALLATION

- A. The contractor shall comply with all laws, from all appropriate jurisdictions, that pertain to the construction, operation, and maintenance of reclaimed water distribution systems during construction and during the establishment period. No additional payment shall be made to the contractor for constructing the system according to these laws.
  - 1. The irrigation system will be operated to avoid ponding. To minimize ponding or runoff, the reclaimed water shall be applied at a rate that does not exceed the infiltration rate of the soil.

2. tion rate of the soil.

B. Excavating and Trenching: Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, necessary in accordance with requirements of Section 32 91 13. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original condition.

1. Should utilities not shown on the plans be found during excavations, promptly notify Landscape Architect for instructions. Failure to do so will make Contractor liable for any and all damage arising from his operations subsequent to discovery. Indicate utility crossings on the Record Drawings promptly.
2. do so will make Contractor liable for any and all damage arising from his operations subsequent to discovery. Indicate utility crossings on the Record Drawings promptly.
3. Minimum burial shall be as shown on the Irrigation Trenching Detail.
4. Trenches located under areas where paving, asphaltic concrete or concrete will be installed shall be backfilled with sand (a layer 6 inches below the pipe and 3 inches above the pipe) and compacted in layers to 90% compaction, using manual or mechanical tamping devices. Trenching for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm, unyielding condition. All trenches shall be left flush with the adjoining grade. The irrigation Contractor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
5. tor shall set in place, cap, and pressure test all piping under paving prior to the paving work.
6. Provide for a minimum cover of 24 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.
7. Depths shown on details shall not be exceeded by three inches without prior approval.
8. Where it is necessary to excavate adjacent to existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Excavation in areas where 2 inches and larger roots occur shall be done by hand. All roots 6 inches and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a ditching machine is run close to trees having roots smaller than 2 inches in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts. Trenches adjacent to trees should be closed within 24 hours, and where this is not possible the side of the trench adjacent to the tree shall be kept shaded with burlap or canvas.

C. Conduits and Sleeves:

1. Provide conduit where control wires pass under or through walls. Conduits shall be of adequate size to accommodate retrieval for repair of wiring and shall extend 12 inches beyond edge of walls.

2. Install sleeves for pipes passing through or under walls, walks, and paving as shown on Drawings. Sleeving shall be of adequate size to accommodate retrieval for repair of wiring or piping, and shall extend a minimum of 12 inches beyond edge of paving or other construction. Each sleeve shall be taped along its entire length with metallic locator tape manufactured for that purpose.
  3. tire length with metallic locator tape manufactured for that purpose.
  4. Coordinate conduit and sleeve installation with other trades as required.
  5. All sleeving shall be Schedule 40 PVC solvent weld PVC pipe or approved corrugated HDPE.
  6. All joints shall be solvent welded. Welds to be primed and glued as per pipe size.
  7. All sleeves shall be capped and kept clean of dirt and debris during construction.
  8. Excavation and backfill shall be as specified in latest edition of the Standard Specifications for Public Works Construction (SSPWC) and all other Standards and Specifications utilized by City of Lancaster during the course of construction.
  9. Sleeves shall have a minimum horizontal clearance of 12 inches from each other and other piping. Sleeves shall not be installed parallel and directly over another line. Sleeves shall have a minimum of 6 inches vertical clearance where they cross other lines.
  10. Sleeves shall be a minimum size of 2 inches or 2 pipe sizes larger than the pipe being sleeved. Each pipe shall have its own sleeve unless approved by the Owner's Representative.
  11. Location of sleeves shall be shown on the record drawings.
- D. Pipe Line Assembly: Install pipes and fittings in accordance with manufacturer's latest printed instructions. Clean all pipes and fittings of dirt, scales, and moisture before assembly. Carefully place pipe, fittings, and valves, etc., in the trenches. Interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress; open ends of pipe shall be closed by caps or other approved means. All lateral connections to the mainline as well as all other connections shall be made to the side of the mainline pipe. Connections to the top of the lines are not allowed. PVC piping shall be kept protected from damaging ultraviolet rays during storage and while in the trench. Piping that has become discolored due to exposure to ultraviolet rays shall be replaced.
- E. o the side of the mainline pipe. Connections to the top of the lines are not allowed. PVC piping shall be kept protected from damaging ultraviolet rays during storage and while in the trench. Piping that has become discolored due to exposure to ultraviolet rays shall be replaced.
1. Solvent-Welded Joints for PVC Pipes: Use solvents and methods by pipe manufacturer. Cure joint a minimum of 1 hour before applying any external stress on piping, and at least 24 hours before placing joint under water pressure.
  - 2.
  3. Threaded Joints for Plastic Pipes: Use Teflon tape on threaded PVC fittings, except where Marlex fittings are used. Use strap type friction wrench only. Do not use metal-jawed wrench. When connection is plastic to metal, use male

adapters. Male adapters shall be hand tightened, plus 1 turn with a strap wrench. Joint compound shall be Teflon tape.

4. Laying of Pipe:

- a. Bed pipes in at least 2 inches of finely divided material, with no rocks or clods over 1 inch diameter, to provide a uniform bearing. Snake pipe from side to side of trench bottom to allow for expansion and contraction at a minimum allowance for snaking of 1 additional foot per 100 feet of pipe. Do not lay PVC pipe when there is water in the trench.
- b. Install plastic pipe in a manner so as to provide for expansion and contraction as recommended by the manufacturer. Cut plastic pipe with PVC pipe cutters or hacksaw, or in a manner so as to ensure a square cut. Remove burrs at cut ends prior to installation so that a smooth unobstructed flow will be obtained. Solvent weld or slip seal plastic to plastic joints. Use only the solvent recommended by pipe manufacturer. Install plastic pipe and fittings as outlined and instructed by the pipe manufacturer. Make arrangements with pipe manufacturer for field assistance that may be required.
- c. Make arrangements with pipe manufacturer for field assistance that may be required.
- d. All lines shall have a minimum clearance of 6 inches from each other, and from lines of other trades. Parallel lines shall not be installed directly over one another.
- e. Gate Valves: Group valves together and locate in planted areas where possible. Install box flush with finish grade.

F. Irrigation Control Valves: Install control valves in valve boxes where shown on plans, and group together where practical. Place no closer than 12 inches to walk edges, buildings, and walls. Install valve boxes flush with finish grade.

1. Chart may be a reproduction of the Record Drawing. Charts shall be reduced to fit in the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
2. Irrigation chart shall show clearly all valves operated by the controller, showing station number, valve size, and type of planting irrigated. Diagram the area of coverage of each remote control valve, using a distinctly different transparent pastel color, drawn over the entire area of coverage.
3. Chart shall be a bond print of the actual system, showing the area covered by that controller.

G. Control Wiring: Install control wires with mains and laterals in common trenches wherever possible as shown on plans.

1. Wiring between the Master Valves and Flow Sensors shall be as recommended by the manufacturers. The wiring shall be installed in plastic Sch. 40 PVC electrical conduit no less than 1 inch in size. All electrical connections at the Flow Sensor / Master Valve shall be completely sealed using a two-part epoxy such as 3M or pentite system. Pre-jelled fittings are not acceptable. Splices between the

devices and controllers are not allowed without pre-approval in writing by Owner's representative.

2. Lay to the side of pipe line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at 10 feet intervals. Crimp and seal control wire splices at remote control valves with specified splicing materials. Line splices are allowed only on runs of more than 500 feet. Line splices shall be Marconi-type, taped and sealed with Scotchkote Sealer. Install a minimum of 1 extra control wire to the control valve located the greatest distance from the controller in both directions and label each end blank.

H. Mechanically Restrained Joints/ Concrete Thrust Blocks.

1. Mechanically restrained joints or concrete thrust blocks shall be installed at specific locations per manufacturer's recommendations and the pressure testing requirement shall be 150 psi. Mechanically restrained joints or concrete thrust blocks shall be installed for main lines at all changes in direction, elevation, gate valves and tees for all main lines larger than 2 inches. All thrust blocks must bear on undisturbed soil.

I. Closing of Pipe and Flushing of Lines: Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation. Thoroughly flush out all water lines before installing heads, valves, and test as specified. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.

J. Installation of Risers: Install riser assemblies as shown on the Drawings. Do not assemble to pipe until flushing is completed. Take care prior to riser installation that pipe is kept free of foreign matter after flushing and prior to riser installation. Coordinate installation with planting.

K. not assemble to pipe until flushing is completed. Take care prior to riser installation that pipe is kept free of foreign matter after flushing and prior to riser installation. Coordinate installation with planting.

L. Backfill and Compacting:

1. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris, in accordance with requirements of Excavation and Fill Section 31 23 00.
2. Dress off all areas to finish grades.

M. Planters on Structure Installation: Water will be brought to planters through plumbing chase. Landscape drip line shall then be installed within planter soil profile per Hydrotech product representative's recommendation. Layout landscape drip line per project details.



### 3.3 FIELD QUALITY CONTROL

#### A. Inspections:

1. The Contractor shall give a minimum of 48 hours advance notice to the Landscape Architect, and plumber for required inspections.
2. All irrigation routing shall be flagged and inspected by the Landscape Architect prior to trenching. Any trenching work installed prior to inspection may be amended at the Contractor's expense to allow correct alignment.
3. All irrigation installations shall be inspected by the Landscape Architect prior to the work being covered. Any work covered prior to a required inspection shall be uncovered at the Contractor's expense to allow inspection.
4. Required Inspections shall be as follows:
  - a. Point of Connection Location, Backflow Preventer Location, Controller Location
  - b. Mainline Routing, Valve, Flow Sensor, Master Valve Layout
  - c. Mainline and Thrust Block Inspection
  - d. Master Valve, Flow Sensor, Valve and Control Wire
  - e. Controller and Controller Grounding
  - f. Lateral and Component Inspection
  - g. Lateral Line Pressure Test
  - h. Head Coverage Test
  - i. Final Audit and Controller Scheduling

#### B. Testing: Notify Landscape Architect at least 48 hours prior to date scheduled for observation and testing. Prior to backfilling and after Landscape Architect's observation, make hydrostatic tests when welded PVC joints have cured as follows:

1. Pressurized Mains.
  - a. Completely install water meter, mains, isolation valves, and control valves. Do not install laterals.
  - b. Open all isolation valves.
  - c. Fill all lines with water and shut off at meter.
  - d. Pressurize the main with air to 70 psi. Monitor gauge for pressure loss for 4 hours.
  - e. Leave lines and fittings exposed throughout testing period.
  - f. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
  - g. Test all valves for leakage.
2. Non-pressure Laterals:
  - a. Test piping after laterals and risers are installed and system is fully operational.
  - b. Leave trenches open to detect possible leaks.

#### C. Walk-Through for Substantial Completion:

1. Arrange for Landscape Architect's presence 48 hours in advance of walk-through.

2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
3. Operate each zone in its entirety for the Landscape Architect at time of walk-through and open all valve boxes.
4. Landscape Architect shall generate a list of items to be corrected prior to Final Completion.
5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents, and as directed by consultant.

D. Walk-Through for Final Completion:

1. Arrange for the Landscape Architect's presence 48 hours in advance of walk-through.
2. The Contractor shall be required to supply the following tools as part of the construction contract:
  - a. Two sets of special tools required for removing, disassembling and adjusting each type of valve supplied on this project.
  - b. Three valve box keys or wrenches.
  - c. One gate valve key (where applicable).
3. Show evidence to the Landscape Architect that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
4. Operate each zone, in its entirety, for the Landscape Architect at time of walk-through to insure correction of all incomplete items.
5. Items deemed unacceptable by Landscape Architect shall be reworked to complete satisfaction of Architect/Landscape Architect without additional cost to the owner.
6. If, after request to Landscape Architect for walk-through for Final Completion of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Landscape Architect to conduct and document further walk-throughs as deemed necessary to ensure compliance with Contract Documents.

3.4 ADJUSTING

- A. Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting patterns and break up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage.
- B. If it is determined that irrigation adjustments will provide proper and more adequate coverage, make such adjustments prior to final acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in control valve throttling.

- C. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the owner.

### 3.5 CLEANING

- A. Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash or debris generated by installation of irrigation system.
- B. Clean up, remove from project area and lawfully and properly dispose of all debris from the entire work area prior to Final Acceptance to satisfaction of Landscape Architect.

END OF SECTION 32 84 00

## SECTION 32 91 13 - SOIL PREPARATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Soil in the Project shall consist of on-site material and import planting soil. The import planting soil is meant to provide a soil material suitable for plant.
- B. Section includes:
  - 1. Planting Soil
  - 2. Furnish components of the planting mediums.
  - 3. Testing and/or certifications of components.
  - 4. Mixing of planting mediums.
  - 5. Transporting mediums as required.
  - 6. Machinery and loading restrictions.
  - 7. Imported Soils and Final Landscape Grading
- C. Related Requirements:
  - 1. Earth Moving. See Section 31 20 00 for excavation, filling and rough grading.
  - 2. Planting & Irrigation. See Section 32 84 00.

#### 1.2 SUBMITTALS

- A. Product Data:
  - 1. Soil amendments
  - 2. Planting Soil
  - 3. Sand
  - 4. Mulch
  - 5. Imported Soil

#### 1.3 QUALITY ASSURANCE

- A. Certificates of Inspection: Certificates of inspection required for transportation shall accompany invoice for each shipment of materials. File copies of certificates with Landscape Architect after acceptance of material.
- B. Testing:
  - 1. All soil components shall be tested by a testing laboratory acceptable to Landscape Architect for conformity to the Specifications.

2. If herbicide contamination is suspected, then a bio assay shall be performed.
3. For delivered material, test 1 grab sample for each 50 cubic yards of bulk material delivered to the site.
4. Testing will be at the expense of Contractor.
5. Deviations greater than plus or minus 20 percent from control data may be grounds for rejection of mixes tested. Nonconforming materials shall not be used. Materials which do not conform to standards specified herein shall be removed from the Site.
6. Testing for import planting soil shall provide: Half Sat.%, pH, ECe, TEC (total exchangeable cat ions), NO<sub>3</sub>-N, NH<sub>4</sub>-N, P, K, Ca, Mg, Cu, Zn, Mn, Fe, s & Na. Organic Matter %, USDA particle size appraisal and sufficiency factors for each element and a soils report detailing soil amendment, planting guidelines and fertilizer recommendations.
7. t detailing soil amendment, planting guidelines and fertilizer recommendations.
8. Texas Root Rot: Many of the tree species required in this project are susceptible to this disease. It is recognized that there is no test to determine the existence of this fungus in soil prior to planting. According to the University of Arizona Plant Disease specialists there is no known control. Since the fungus is known to be prevalent in cotton field, t
9. Structural characteristics for small structures: Testing shall be conducted and supplied by others to conform to the requirements provided by the Landscape Architect.
10. ape Architect.

## PART 2 - PRODUCTS

### 2.1 ON-SITE MATERIALS

- A. Test on-site topsoil designated stockpile area or borrow site for conformity to above analysis. Submit test to Landscape Architect for verification and alteration of components, if applicable.
- B. No white wood or filler material will be allowed.

### 2.2 IMPORT MATERIALS

- A. Grading:

Sieve Size	Percent Passing Sieve
2 inches	100
1/2 inch	85-100
No. 40	35-85

B. Chemistry - Suitability Considerations:

1. Soluble Salts: 2000 ppm maximum.
2. Calcium Carbonate: 8 percent maximum.
3. Exchangeable Sodium: 5 percent maximum.
4. pH: 6.0 - 8.0.
5. Plasticity Index: 5 - 20.

C. Pests: The population of any single species of plant pathogenic nematode: Fewer than 500 per pint of soil.

D. Fertility Considerations: Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium, and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials to overcome inadequacies prior to planting.

E. Source of above shall be approved, and conformity of material to above analysis shall be laboratory verified for each 100 cubic yards of material delivered to the Site.

2.3 COMPOST

- A. Shall consist of composted bark and be organic humic and nitrogen stabilized.

2.4 MULCH

- A. Top dressing shall be Everbloom organic mulch applied 3" thick where indicated in plans.

2.5 CHEMICAL ADDITIVES

- A. The following soil components listed may have a particular application specified within this Section. Some of the soil components included shall be applied at rates determined by the contractor from the soil tests called for under other paragraphs of this Section, or as a result of soil tests. Some of the components may not be required by the soils test.

- B. Ground Limestone: Agricultural limestone containing not less than 85 percent of total carbonates, ground to such fineness that 50 percent will pass a 100 mesh sieve and 90 percent will pass a 20 mesh sieve.
- C. 0 mesh sieve and 90 percent will pass a 20 mesh sieve.
- D. Dolomite Lime: Agricultural grade mineral soil conditioner containing 35 percent minimum magnesium carbonate and 49 percent minimum calcium carbonate, 100 percent passing No. 65 sieve. Kaiser Dolomite 65 AG.
- E. Gypsum: Agricultural grade product containing 80 percent minimum calcium sulphate.
- F. Iron Sulphate (Ferric or Ferrous): Shall contain 30 percent to 35 percent iron, 35 percent to 40 percent sulphur and be supplied by a commercial fertilizer supplier.
- G. Sulphate of Potash: Agricultural grade containing 50 percent to 53 percent of water soluble potash.
- H. Single Superphosphate: Commercial product containing 19 percent to 20 percent available phosphoric acid.
- I. Ammonium Sulphate: Commercial product containing approximately 21 percent ammonia.
- J. Ammonium Nitrate: Commercial product containing approximately 34 percent ammonia.
- K. Calcium Nitrate: Agricultural grade containing 15-1/2 percent nitrogen.
- L. Urea Formaldehyde: Commercial product containing 38 percent nitrogen.
- M. I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing 31 percent nitrogen.
- N. Soil Sulphur: Granular or prilled agricultural grade sulphur containing a minimum of 99.5 percent sulphur and 0.5 percent inert ingredients.
- O. Iron Chelate Micronutrient: Sequestrene - 330 Fe; 0-0-0; 10 percent Fe; Ciba-Geigy Company.

## 2.6 PLANTING SOIL

- A. Shall be mixed thoroughly in the following proportions:
  - 1. Tree and Shrub Planting Soil:
    - a. six (6) parts volume site soil
    - b. four (4) parts by volume organic humic nitrogen stabilized compost.
    - c. 1 lb. 12-12-12 commercial fertilizer per cu. yd.
    - d. 1 lb. iron sulfate per cu. yd. of mix

- e. twenty (20) lbs. grow-power plus"
  - f. twenty lbs. agricultural gypsum
  - g. Plant Tablet:
    - 1) 1 - 21 gram Agriform fertilizer per every ½" caliper for box trees.
- B. The ratio of the mix component may be altered during the Contract period to meet site conditions.
- C. Chemical Additives (To Be Determined by Soil Tests): pH shall be maintained at 6.0 to 8.0.
- D. Litetop Extensive Media will be used as the planting media in planters.
- E. Planters will have Permanent drip irrigation and planter drains will be provided. Succulents and low water use plants are specified.

## 2.7 SUCCULENT BACKFILL

- A. Shall be a ratio of one part compost to three parts clean site soil or planting soil.
- B. Soil shall be free of stones or lumps.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. The contractor shall determine the true and final horizontal limits of these subsurface soils and their vertical depth below finish grade and visually mark in the field for this Work and for coordination with other trades prior to beginning this Work.
- B. Schedule all work to minimize interference with other trades and the public.
- C. Should any unforeseen or unsuitable planting conditions arise, they shall be called to the attention of the Landscape Architect.

### 3.2 SOIL PREPARATION

- A. Perform soil preparation only when soil conditions are not saturated.
- B. Clean-up shall occur daily with the work protected from the public. Contractor shall immediately remove all unused materials, debris and equipment from the site when completed.



### 3.3 MIXING

- A. Mix soil base, amendments, and chemical additives by mechanical means. Do not mix additives with excavated material at the plant pit site.
- B. Mechanical means should thoroughly mix all amendments with soil or soil-less base.
- C. Soil and sand bases shall be completely pulverized and free of lumps or aggregated material. Moisture content of base materials shall not be such that chemical granular or pelletized additives become dissolved before thorough mixing.
- D. Mix media in quantities of not less than 50 cu yds or mix total quantity required if less than 100 cu yds. The Contractor shall be responsible for continuity between batches.
- E. Landscape Architect reserves the right to take, and have a Soils Testing Laboratory analyze, soil samples at the site. Samples not conforming to the Specifications shall be immediately removed from the site at no additional cost to the owner. Replacements shall be subject again to all requirements of this Section at no additional cost to the owner.
- F. st to the owner.
- G. Contractor shall bear final responsibility for proper surface drainage of planted areas away from foundations. Any discrepancy in the Drawings or Specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage, shall be brought to the attention of Landscape Architect in writing for correction, or relief of, said responsibility.
- H. The Contractor shall keep in storage, at his own expense, sufficient quantities of mix to repair any settling, or to adjust grades throughout the warranty period.

### 3.4 FINISHED GRADING

- A. Finished grading shall conform with plans with even and smooth transitions between grades.

END OF SECTION 32 91 13

## SECTION 32 93 00 - PLANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plant materials.
2. Organic Amendment.
3. Herbicides and pesticides.
4. Root Barrier.
5. Aluminum Edging.
6. Landscape Filter Fabric.
7. Coordination with California Conservation Corp (CCC) for installation of plants and trees. See Part H of these specifications for additional requirements.

B. Related Requirements:

1. Section 01 56 39 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 32 84 00 "Planting Irrigation" for complete irrigation systems.

#### 1.2 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Landscape Inspector: Authorized representative of the Owner.
- E. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

- G. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- H. Planting Area: Areas to be planted.
- I. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- K. Root Control Barrier: Geotextile fabric placed adjacent to pavement that is imbedded with nodules that release chemicals in a time release fashion to provide both a physical and chemical barrier zone to restrict vegetative root encroachment.
- L. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- M. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. Weed Barrier: A geotextile fabric placed under decomposed granite paving and cobble rock mulch to inhibit weed growth from the subgrade and to provide a physical separation between the rock materials and the base or subgrade.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
  - 2. Organic Amendment: Manufacturer's product data sheet indicating pH, salinity, as received/dry bulk density, moisture content, total nitrogen, organic percentage

- dry weight, organic matter in pounds per cubic yard, particle sizes, half saturation percentage, dilute acid extractable iron and estimated carbon to nitrogen ratio.
3. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
  4. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
  5. Root Barrier: Manufacturer's product data sheet.
  6. Aluminum Edging: Manufacturer's product data sheet
  7. Landscape Filter Fabric: Manufacturer's product data sheet.
- B. Samples for Verification: Actual sample of finished products for each of the following:
1. Organic Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.
  2. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
  3. Aluminum Edging: 6-inch long edging section.
  4. Root Barrier: Width of panel by 12 inches.
  5. Landscape Filter Fabric: 12 by 12 inches.
- C. Soil Composition Test Results.
- D. Field Percolation Test Results.
- E. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Manufacturer's certified analysis of standard products.
- F. Planting Schedule: Include dates and durations of installation of plants and trees performed by CCC.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers that include a superintendent and landscape foreman who are California Landscape Contractors Association Certified Landscape Technician for softscape installation.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  2. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Composition Tests:
1. Provide commercial test and soil amendment recommendations from an independent testing laboratory for drought tolerant trees, shrubs and ground covers for a low desert region. Testing shall include basic soil classification groups, moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D 4972), soil salinity, secondary nutrient groups (calcium, magnesium, sodium) Sodium Absorption Ratio (SAR), micronutrients (zinc, manganese, iron, copper) toxic soil elements (boron, chloride, sulfate) cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being planted. Soil required for each test shall include a maximum depth of 18 inches of approximately 1 quart volume for each test (verify with laboratory prior to sampling). Provide one sample for each 25,000 square feet of site area or portion thereof. Samples shall contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.
  2. Report suitability of tested soil for plant growth.
    - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- D. Field Percolation Test: Immediately following rough grading operation, identify a typical location for one of the largest trees and shrubs and excavate one pit each per the project details. In the presence of the Landscape Architect and/or the Landscape Inspector, fill the pit with water to a depth of 12 inches. Within six hours of the time the water has drained from the pit, the Contractor, with the Landscape Inspector and project Landscape Architect present, shall again fill the pit with water to a depth of 12 inches. The length of time required for the water to percolate into the soil, leaving the pit empty, shall be measured and recorded in the presence of the Landscape Inspector on an hourly basis over a 12-hour period and submitted to the project Landscape Architect. If the water does not completely percolate into the soil within 9 hours, a determination shall be made by the Landscape Architect as to whether a supplemental

drainage system will be designed for trees and a soil penetrant will be required for each shrub being planted.

- E. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- F. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
  - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
  - 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- G. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
  - 1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.
- H. Pre-installation Conference: Conduct conference at Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, or walkways and pavements; or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy

their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

- D. Handle planting stock by root ball.
- E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
  - 1. Do not remove container-grown stock from containers before time of planting.
  - 2. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

#### 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of each service or utility.
  - 2. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions in accordance with manufacturer's written instructions and warranty requirements.

#### 1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
    - b. Structural failures, including plantings falling or blowing over.

- c. Faulty performance of tree stabilization .
  - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 2. Warranty Periods: From date of final acceptance by the Owner>.
  - a. Trees: 365 days.
  - b. Shrubs, Vines, Perennials and other plants: 120 days.
- 3. Include the following remedial actions as a minimum:
  - a. Immediately remove dead plants and replace.
  - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
  - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
  - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

## 1.8 MAINTENANCE PERIOD

- A. Initial Maintenance Period: Provide maintenance by skilled employees of the landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than 90 calendar days minimum from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PLANT MATERIALS

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
  - 1. Trees with damaged, crooked, or multiple leaders; with tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); with crossing trunks; with cut-off limbs more than **3/4 inch (19 mm)** in diameter; or with stem girdling roots are unacceptable.



2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare in accordance with ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for plant.

## 2.2 INORGANIC SOIL AMENDMENTS

- A. General: Below are inorganic soil amendments that are commonly used in this area. Final soil amendment list will be determined by the results of the Soil Composition Test.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

## 2.3 ORGANIC SOIL AMENDMENTS

- A. General: Below are organic soil amendments that are commonly used in this area. Final soil amendment list will be determined by the results of the Soil Composition Test.
- B. Compost: AgriService Humic Compost or approved equal. Well-composted, stable, and weed-free organic matter, moisture content 25 to 35 percent by weight; 100 percent passing through 3/8-inch sieve; soluble salt content of <4 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: Minimum 50 percent of dry weight.
2. Carbon to Nitrogen Ratio: 35:1 or lower.
3. pH: Between 6 and 8.
4. Feedstock: Clean, source-separated yard trimmings. No animal or sludge wastes.

## 2.4 FERTILIZERS

- A. General: Below are fertilizers that are commonly used in this area. Final fertilizer list will be determined by the results of the Soil Composition Test.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
- E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
  1. Size: 5-gram and 21-gram tablets.
  2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.
- F. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

## 2.5 MULCHES

- A. Organic Mulch: As indicated on the Drawings.
- B. Gravel Mulch: As indicated on the Drawings.

## 2.6 LANDSCAPE FILTER FABRIC

- A. Nonwoven Geotextile Filter Fabric: Mirafi Mscape needle-punched, nonwoven geotextile fabric or equal.

## 2.7 HERBICIDES AND PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. All pesticides used near natural water courses or man-made storm water bioswales shall be water safe, non-toxic to aquatic life and use a non-ionic surfactant.
- C. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- D. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

## 2.8 TREE-STABILIZATION MATERIALS

- A. Stakes and Guys:
  - 1. Upright Stakes: Sound, new softwood with approved wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-inch diameter nominal by length indicated, pointed at one end. PacWest Lumber or approved equal.
  - 2. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes. VIT Cinch-Ties or approved equal.
- B. Palm Bracing: Battens or blocks, struts, straps, and protective padding as needed.

## 2.9 LANDSCAPE EDGINGS

- A. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes, as indicated on the drawings. Curv-Rite 3000 3/16" x 4" or approved equal.

## 2.10 MISCELLANEOUS PRODUCTS

- A. Root Barrier: Biobarrier or approved equal. Root barrier shall be 24 inches wide for the protection of pavements and mow curbs, 39 inches wide for the protection of underground utilities.
- B. DG and Rock Cobble Mulch Separation Fabric: Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them. Mirafi Mscape or approved equal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
  - 3. Suspend planting operations during periods of excessive soil moisture until moisture content reaches acceptable levels to attain required results.
  - 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove soil and contamination as directed by Landscape Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

### 3.3 PLANTING AREA ESTABLISHMENT

- A. For areas to receive plantings at 24-inches on center or less, loosen soil of planting areas to a minimum depth of 9 inches, or as recommended by the Soil Composition Test, by ripping and tilling in two directions. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

- B. For plantings 24 inches on center or less, apply soil amendments as recommended in the Soil Composition Test report directly to grade after loosening. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
- C. Finish Grading: Grade planting areas in accordance with the project grading plan to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- D. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.4 EXCAVATION FOR TREES, SHRUBS AND VINES

- A. Planting Pits and Trenches: Excavate planting pits as indicated on the drawings. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
- B. Subsoil and topsoil removed from excavations may be used as planting soil unless otherwise directed by the Landscape Architect or Landscape Inspector.
- C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.
- D. Based upon the result of the mandatory Percolation Test, the Landscape Architect will determine if a piped or tree well drainage system is required. Also notify the Landscape Inspector and Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

### 3.5 TREE, SHRUB, AND VINE PLANTING

- A. Coordinate and schedule CCC personnel to be onsite for installation of plantings. See Part H of these specifications for additional requirements.
- B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- C. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

- D. Scarify plant root ball sides and bottom, tree root balls a minimum of 1-inch deep and shrub root balls a minimum of 1/2-inch deep. Loosen circling or matted roots.
- E. Set container-grown stock plumb and in center of planting pit or trench as indicated on the drawings.
- F. Backfill plants as indicated on the drawings. Trees shall receive amended backfill in the top 12 inches with the remainder being native soil. Shrubs shall receive amended backfill mix in the top half of the backfill and the remainder being native soil.
- G. Backfill in lifts and thoroughly settle with water between lifts.

### 3.6 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Do not apply pruning paint to wounds.

### 3.7 TREE STABILIZATION

- A. Install trunk stabilization as follows unless otherwise indicated:
  - 1. Upright Staking and Tying: Stake trees as indicated on the drawings.

### 3.8 INSTALLATION OF ROOT BARRIER

- A. Install root barrier where and as indicated on the plans. Not all required root barriers are shown.
- B. Align root barrier vertically and run it linearly along and adjacent to the paving, utility or other hardscape elements to be protected from invasive roots.
- C. Install root barrier continuously for 10 feet in each direction from the tree trunk, for a total distance of 20 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
  - 1. Position top of root barrier per manufacturer's recommendations.
  - 2. Overlap root barrier a minimum of 12 inches at joints.
  - 3. Do not install root barrier surrounding the root ball of tree.

### 3.9 GROUND COVER AND PLANT PLANTING

- A. Amend and till the soil as noted above for all plantings spaced 24 inches on center or less.

- B. Set out and space ground cover shrubs and plants as indicated on the drawings in even rows with triangular spacing.
- C. Dig holes large enough to allow spreading of roots.
- D. Use planting soil for backfill and add fertilizer tablets when backfill is installed to half the root ball depth.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.10 PLANTING AREA MULCHING

- A. Install landscape filter fabric according to manufacturer's written instructions before mulching areas to receive inorganic gravel mulch. Do not install filter fabric in areas to receive organic mulch. Completely cover area to be mulched, overlapping edges a minimum of 12 inches and secure seams with galvanized pins
- B. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 1. Organic Mulch in Planting Areas: Apply 3-inch minimum thickness of organic mulch in individual plant watering basins and over whole surface of perennial mix planting areas, and finish level with adjacent finish grades. Do not place mulch within 3 inches of tree trunks or plant stems.
  - 2. Gravel Mulch in Planting Areas: Apply 3-inch minimum thickness of gravel mulch over whole surface of planting area as indicated on the Drawings, and finish level with adjacent finish grades. Do not place mulch within 3 inches of tree trunks or plant stems.

### 3.11 INSTALLATION OF LANDSCAPE EDGINGS

- A. Concrete Edging: Install edging as indicated on the drawings.
- B. Aluminum Edging: Install aluminum edging where indicated according to Manufacturer's details and written instructions.

### 3.12 APPLICATION OF HERBICIDES AND PESTICIDES

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

- B. All pesticides used near natural water courses or man-made storm water bioswales shall be water safe, non-toxic to aquatic life and use a non-ionic surfactant.
- C. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- D. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

### 3.13 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

### 3.14 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and as directed by the Landscape Inspector, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

### 3.15 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 32 93 00



## SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Piping joining materials.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Sleeves.
  - 5. Identification devices.
  - 6. Grout.
  - 7. Flowable fill.
  - 8. Piped utility demolition.
  - 9. Piping system common requirements.
  - 10. Equipment installation common requirements.
  - 11. Painting.
  - 12. Concrete bases.
  - 13. Metal supports and anchorages.

#### 1.3 DEFINITIONS

- A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.
- B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- C. ABS: Acrylonitrile-butadiene-styrene plastic.
- D. CPVC: Chlorinated polyvinyl chloride plastic.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.8 COORDINATION

- A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.
- C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

## PART 2 - PRODUCTS

### 2.1 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness, unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D2235.
  - 2. CPVC Piping: ASTM F493.
  - 3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
  - 4. PVC to ABS Piping Transition: ASTM D3138.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

### 2.2 TRANSITION FITTINGS

- A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings NPS 1-1/2 (DN 40) and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
  2. Aboveground Piping: Specified piping system fitting.
- C. AWWA Transition Couplings NPS 2 (DN 50) and Larger:
1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- D. Plastic-to-Metal Transition Fittings:
1. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.
- E. Plastic-to-Metal Transition Unions:
1. Description: MSS SP-107, CPVC and PVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.
- F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:
1. Description: ASTM C1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

## 2.3 DIELECTRIC FITTINGS

- A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
1. Description: Factory fabricated, union, NPS 2 (DN 50) and smaller.
    - a. Pressure Rating: 150 psig (1035 kPa) minimum at 180 deg F (82 deg C).
    - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.
- C. Dielectric Flanges:
1. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.
    - a. Pressure Rating: 150 psig (1035 kPa) minimum
    - b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:

1. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.
  - a. Pressure Rating: 150 psig (1035 kPa) minimum
  - b. Gasket: Neoprene or phenolic.
  - c. Bolt Sleeves: Phenolic or polyethylene.
  - d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 (DN 80) and smaller.

F. Dielectric Nipples:

1. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.
  - a. Pressure Rating: 300 psig at 225 deg F
  - b. End Connections: Threaded or grooved.

## 2.4 SLEEVES

- A. Mechanical sleeve seals for pipe penetrations are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- E. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

## 2.5 IDENTIFICATION DEVICES

- A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  2. Location: Accessible and visible.
- C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches (30 mm) for ducts, and 3/4 inch (20 mm) for access door signs and similar operational instructions.
1. Material: per manufacturer
  2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
  3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.
- F. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers, extending 360 degrees around pipe at each location.
- G. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.
- H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.
- I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.
- J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.
1. Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.
  2. Color: Comply with ASME A13.1, unless otherwise indicated.
- K. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.
1. Shape: As indicated for each piping system.

- L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.
- M. Engraved Plastic-Laminate Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
  - 2. Thickness: 1/16 inch unless otherwise indicated.
  - 3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.
- N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
  - 1. Green: Cooling equipment and components.
  - 2. Yellow: Heating equipment and components.
  - 3. Brown: Energy reclamation equipment and components.
  - 4. Blue: Equipment and components that do not meet criteria above.
  - 5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
  - 6. Terminology: Match schedules as closely as possible. Include the following:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - 7. Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
  - 1. Size: 3-1/4 by 5-5/8 inches (83 by 143 mm).
  - 2. Fasteners: Brass grommets and wire.
  - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.
  - 1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

## 2.6 GROUT

- A. Description: ASTM C1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## 2.7 FLOWABLE FILL

- A. Description: Low-strength-concrete, flowable-slurry mix.
  - 1. Cement: ASTM C150, Type I, portland.
  - 2. Density: 115- to 145-lb/cu. ft.
  - 3. Aggregates: ASTM C33, natural sand, fine and crushed gravel or stone, coarse.
  - 4. Water: Comply with ASTM C94/C94M.
  - 5. Strength: 100 to 200 psig at 28 days.

# PART 3 - EXECUTION

## 3.1 PIPED UTILITY DEMOLITION

- A. Refer to Section 02 41 19 "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.



### 3.2 DIELECTRIC FITTING APPLICATIONS

- A. Dry Piping Systems: Connect piping of dissimilar metals with the following:
  - 1. NPS 2 (DN 50) and Smaller: Dielectric unions.
  - 2. NPS 2-1/2 to NPS 12 (DN 65 to DN 300): Dielectric flanges or dielectric flange kits.
- B. Wet Piping Systems: Connect piping of dissimilar metals with the following:
  - 1. NPS 2 (DN 50) and Smaller: Dielectric couplings
  - 2. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Dielectric nipples.
  - 3. NPS 2-1/2 to NPS 8 (DN 65 to DN 200): Dielectric nipples or dielectric flange kits.
  - 4. NPS 10 and NPS 12 (DN 250 and DN 300): Dielectric flange kits.

### 3.3 PIPING INSTALLATION

- A. Install piping according to the following requirements and utilities Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.
  - a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
  - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
- I. Verify final equipment locations for roughing-in.

- J. Refer to equipment specifications in other Sections for roughing-in requirements.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- H. Soldered Joints: Apply ASTM B813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.
- I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.
- K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
  3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
  4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
  5. PVC Nonpressure Piping: Join according to ASTM D2855.
  6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.
- L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.
- M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.
- N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
1. Plain-End PE Pipe and Fittings: Use butt fusion.
  2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Install dielectric fittings at connections of dissimilar metal pipes.

### 3.6 EQUIPMENT INSTALLATION

- A. Install equipment level and plumb, unless otherwise indicated.
- B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment to allow right of way to piping systems installed at required slope.

### 3.7 PAINTING

- A. Painting of piped utility systems, equipment, and components is specified in Section 09 91 13 "Exterior Painting," Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.8 IDENTIFICATION

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Stenciled Markers: According to ASME A13.1.
  - 2. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.
  - 3. Locate pipe markers on exposed piping according to the following:
    - a. Near each valve and control device.
    - b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    - c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    - d. At manholes and similar access points that permit view of concealed piping.
    - e. Near major equipment items and other points of origination and termination.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.
  - 1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
  - 2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

### 3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Section 03 30 00 "Cast-in-Place Concrete."

### 3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Section 05 50 00 "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.11 GROUTING

- A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.

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H. Cure placed grout.

END OF SECTION 33 05 00

## SECTION 33 14 15 - SITE WATER DISTRIBUTION PIPING

### 1.1 SUMMARY

- A. Water-distribution piping and related components for domestic water service and fire-suppression water service outside the building.

### 1.2 SUBMITTALS

- A. Coordination drawings.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: NFPA 70.
- B. Materials, Installations, Tests, Flushing, and Valve and Hydrant Supervision for Fire-Service-Main Piping: NFPA 24.
- C. Plastic Potable-Water-Service Piping: NSF 14. Include marking "NSF-pw" on piping.
- D. Water-Service Piping and Specialties for Domestic Water: Comply with SDWA, AHJ, and with NSF 61/NSF 372 or are certified in compliance with NSF 61/NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
- E. Quality Standard for Fire-Service-Main Products: FM Approvals' "Approval Guide."

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Underground Water-Service Piping NPS 3/4 to NPS 3
  - 1. Soft copper tube, ASTM B88, Type K and fittings.
  - 2. PE, ASTM pipe, and PE clamped fittings.
  - 3. PE ASTM pipe, and PE molded heat-fusion fittings.
  - 4. PVC, Schedule 40 pipe and PVC Schedule 40 socket fittings, and solvent-cemented joints.
  - 5. PVC, Schedule 80 pipe and PVC Schedule 80 socket fittings, and solvent-cemented joints.
  - 6. RTRP, AWWA, Class 200 and RTRF bonded fittings/joints.
- B. Underground Water-Service Piping NPS 4 to NPS 8

1. Soft copper tube ASTM B88, Type K and wrought-copper solder-joint fittings, and brazed joints.
  2. Ductile-iron, pipe, and fittings.
  3. Ductile-iron, grooved-end pipe, and ductile-iron-pipe appurtenances.
  4. PE, AWWA pipe and PE AWWA fittings, and heat-fusion joints.
  5. PVC, Schedule 40 pipe and PVC Schedule 40 socket fittings, and solvent-cemented joints.
  6. PVC, Schedule 80 pipe, PVC Schedule 80 socket fittings, and solvent-cemented joints.
  7. PVC, AWWA Class 150 pipe, PVC fabricated fittings, and gasketed joints.
  8. PVC, AWWA Class 200 pipe, PVC, AWWA Class 200 fabricated fittings, and gasketed joints.
  9. RTRP, AWWA pipe Class 200 and RTRF bonded fittings/joints.
- C. Aboveground Water-Service Piping NPS 3/4 to NPS 3:
1. Hard copper tube ASTM B88, Type K and wrought-copper solder-joint fittings, and brazed joints.
  2. PVC, Schedule 80 pipe and PVC Schedule 80 socket fittings, and solvent-cemented joints.
  3. PVC, Schedule 80 pipe and PVC Schedule 80 threaded fittings/joints.
  4. RTRP, AWWA, Class 200 and RTRF bonded fittings/joints.
- D. Aboveground Water-Service Piping:
1. Hard copper tube ASTM B88, Type K wrought-copper fittings.
  2. Ductile-iron, grooved-end pipe and ductile-iron grooved-end appurtenances.
  3. PVC, Schedule 80 pipe and PVC Schedule 80 socket fittings/joints.
  4. PVC, Schedule 80 pipe and PVC Schedule 80 threaded fittings/joints.
  5. RTRP, AWWA, Class 200 and RTRF bonded fittings/joints.
- E. Underground Fire-Service-Main Piping:
1. Ductile-iron, pipe and fittings.
  2. Ductile-iron, grooved-end pipe and ductile-iron-pipe appurtenances.
  3. PE, Class 200, fire-service pipe and molded PE fittings, heat-fusion joints.
  4. PVC, AWWA Class 200 pipe listed for fire-protection service.
  5. Fiberglass, AWWA, FM Global-approved RTRP, Class 200 and RTRF gasketed joints.
- F. Aboveground and Vault Fire-Service Main Piping: Ductile-iron, grooved-end pipe, ductile-iron-pipe appurtenances, grooved joints.
- G. Underground Combined Water-Service and Fire-Service-Main Piping:
1. Ductile-iron, pipe and fittings.
  2. Ductile-iron, grooved-end pipe and ductile-iron-pipe appurtenances.
  3. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe, and gasketed joints.



- 4. Fiberglass, AWWA, FM Global-approved RTRP, Class 200 and RTRF gasketed fittings/joints.
- H. Aboveground and Vault Combined Water-Service and Fire-Service-Main Piping: Ductile-iron, grooved-end pipe, ductile-iron-pipe appurtenances, and grooved joints.
- I. Piping Specialties:
  - 1. Transition fittings.
  - 2. Tubular-sleeve pipe couplings.
  - 3. Split-sleeve pipe couplings.
  - 4. Flexible connectors.
  - 5. Dielectric fittings.
- J. Corrosion-Protection Piping Encasement: Required.

## 2.2 MANUFACTURED UNITS

- A. Gate Valves:
  - 1. AWWA, Cast Iron: resilient seated, C509 or C515, 200 psig
  - 2. UL/FM Global, Cast Iron: resilient seated.
- B. Check Valves: AWWA, 175 psig.
- C. Detector Check Valves: AWWA, 175 psig; including disc type water meter and bypass piping, gate valves, check valve and connections to detector check valve.
- D. Butterfly Valves: AWWA wafer or flanged.
- E. Water Meter Boxes: Polymer-concrete body and cover, with lettering "WATER METER" in cover.
- F. Pressure-Reducing Valves: Direct acting; initial pressure rating 150 psig.
- G. Relief Valves: Air/vacuum valves.
- H. Vacuum Breakers: Pressure vacuum breaker assembly, ASSE 1020.
- I. Backflow Preventers:
  - 1. Reduced-pressure-principle backflow preventers.
  - 2. Double-check, backflow-prevention assemblies.
  - 3. Reduced-pressure-detector, fire-protection backflow preventer assemblies.
  - 4. Double-check, detector-assembly backflow preventers.
  - 5. Backflow preventer test kits.
- J. Concrete Vaults: Required.

K. Fire Hydrants:

1. Dry barrel, AWWA, 250 psig minimum.
2. Wet barrel, AWWA 250 psig minimum.

L. Fire Department Connections: Two inlets.

PART 3 - EXECUTION

A.

END OF SECTION 33 14 15

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## SECTION 33 42 00 - STORMWATER CONVEYANCE

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Ductile-iron culvert pipe and fittings.
2. Ductile-iron, pressure pipe and fittings.
3. Corrugated-steel pipe and fittings.
4. Corrugated-aluminum pipe and fittings.
5. ABS pipe and fittings.
6. PE pipe and fittings.
7. PVC pipe and fittings.
8. Fiberglass sewer pipe and fittings.
9. Concrete pipe and fittings.
10. Non-pressure transition couplings.
11. Pressure pipe couplings.
12. Expansion joints and deflection fittings.
13. Backwater valves.
14. Cleanouts.
15. Drains.
16. Encasement for piping.
17. Manholes.
18. Polymer-concrete, channel drainage systems.
19. Plastic, channel drainage systems.
20. Catch basins.
21. Stormwater inlets.
22. Stormwater detention structures.
23. Pipe outlets.
24. Dry wells.
25. Stormwater disposal systems.

#### 1.2 DEFINITIONS

- ##### A. FRP: Fiberglass-reinforced plastic.

#### 1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.
- ##### B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Catch basins, stormwater inlets and dry wells. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes in accordance with manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets in accordance with manufacturer's written rigging instructions.

#### 1.7 FIELD CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
  1. Notify Architect Construction Manager Owner no fewer than two days in advance of proposed interruption of service.
  2. Do not proceed with interruption of service without Architect's Construction Manager's Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Source Limitations: Obtain hub-and-spigot, cast-iron soil pipe and fittings from single manufacturer.
- B. Pipe and Fittings:
  - 1. Marked with CISPI collective trademark and NSF certification mark.
  - 2. Class: ASTM A74, Service and Extra Heavy class(es).
- C. Gaskets: ASTM C564, rubber.
- D. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

### 2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Source Limitations: Obtain hubless cast-iron soil pipe and fittings from single manufacturer.
- B. Pipe and Fittings:
  - 1. Marked with CISPI collective trademark and NSF certification mark.
  - 2. Standard: ASTM A888 or CISPI 301.
- C. CISPI, Hubless-Piping Couplings:
  - 1. Source Limitations: Obtain CISPI, hubless-piping couplings from single manufacturer.
  - 2. Description: Stainless-steel corrugated shield; stainless-steel bands and tightening devices; and rubber sleeve with integral, center pipe stop.
  - 3. Standards:
    - a. ASTM C1277 and CIPSI 310 for couplings.
    - b. ASTM C564 for gaskets.
- D. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Source Limitations: Obtain heavy-duty, hubless-piping couplings from single manufacturer.
  - 2. Description: Stainless-steel shield; stainless-steel bands and tightening devices; and rubber sleeve with integral, center pipe stop.
  - 3. Standards:
    - a. ASTM C1277 and ASTM C1540 for couplings.
    - b. ASTM C564 for rubber gaskets.
- E. Cast-Iron, Hubless-Piping Couplings:

1. Source Limitations: Obtain cast-iron, hubless-piping couplings from single manufacturer.
2. Description: Two-piece, cast-iron housing; stainless-steel bolts and nuts; and rubber sleeve with integral, center pipe stop.
3. Standards:
  - a. ASTM C1277 for couplings.
  - b. ASTM A48/A48M for cast-iron castings.
  - c. ASTM C564 for gaskets.

## 2.3 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

- A. Pipe: ASTM A716, for push-on joints.
- B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.
- C. Compact Fittings: AWWA C153/A21.53, for push-on joints.
- D. Gaskets: AWWA C111/A21.11, rubber.

## 2.4 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

- A. Source Limitations: Obtain ductile-iron, pressure pipe and fittings from single manufacturer.
- B. Ductile-Iron, Push-on-Joint Piping:
  1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  3. Gaskets: AWWA C111/A21.11, rubber.
- C. Ductile-Iron, Mechanical-Joint Piping:
  1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
  3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

## 2.5 CORRUGATED-STEEL PIPE AND FITTINGS

- A. Source Limitations: Obtain corrugated-steel pipe and fittings from single manufacturer.

- B. Corrugated-Steel Pipe and Fittings: ASTM A760/A760M, Type I with fittings of similar form and construction as pipe.
  - 1. Special-Joint Bands: Corrugated steel with O-ring seals.
  - 2. Standard-Joint Bands: Corrugated steel.
  - 3. Coating: [**Aluminum**] [**Zinc**].

## 2.6 CORRUGATED-ALUMINUM PIPE AND FITTINGS

- A. Source Limitations: Obtain corrugated-aluminum pipe and fittings from single manufacturer.
- B. Corrugated-Aluminum Pipe and Fittings: ASTM B745/B745M, Type I with fittings of similar form and construction as pipe.
  - 1. Special-Joint Bands: Corrugated aluminum with O-ring seals.
  - 2. Standard-Joint Bands: Corrugated aluminum.

## 2.7 ABS PIPE AND FITTINGS

- A. Source Limitations: Obtain ABS pipe and fittings from single manufacturer.
- B. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40.
- D. Cellular-Core ABS Pipe: ASTM F628, Schedule 40.
- E. ABS Socket Fittings: ASTM D2661, made to ASTM D3311, drain, waste, and vent patterns.
- F. Gaskets: ASTM F477, elastomeric seals.

## 2.8 PVC PIPE AND FITTINGS

- A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
- B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. PVC Cellular-Core Piping:



1. PVC Cellular-Core Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, SDR 35, PVC socket-type fittings.

## 2.9 CONCRETE PIPE AND FITTINGS

- A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.
- B. Nonreinforced-Concrete Sewer Pipe and Fittings: **ASTM C14 (ASTM C14M)**, **[Class 1]** **[Class 2]** **[Class 3]**, with **[bell-and-spigot]** **[or]** **[tongue-and-groove]** ends and **[gasketed joints with ASTM C443 (ASTM C443M), rubber gaskets]** **[sealant joints with ASTM C990 (ASTM C990M), bitumen or butyl-rubber sealant]**.
- C. Reinforced-Concrete Sewer Pipe and Fittings: **ASTM C76 (ASTM C76M)**.
  1. **[Bell-and-spigot]** **[or]** **[tongue-and-groove]** ends and **[gasketed joints with ASTM C443 (ASTM C443M), rubber gaskets]** **[sealant joints with ASTM C990 (ASTM C990M), bitumen or butyl-rubber sealant]**

## 2.10 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  1. For Concrete Pipes: **ASTM C443 (ASTM C443M)**, rubber.
  2. For Cast-Iron Soil Pipes: ASTM C564, rubber.
  3. For Fiberglass Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  4. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  5. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
  1. Source Limitations: Obtain unshielded, flexible couplings from single manufacturer.
  2. Description: Elastomeric sleeve with **[stainless-steel shear ring and]** corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, Flexible Couplings:
  1. Source Limitations: Obtain shielded, flexible couplings from single manufacturer.

2. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.11 PRESSURE PIPE COUPLINGS

- A. Source Limitations: Obtain pressure pipe couplings from single manufacturer.
- B. Description: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.
- C. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include [~~150-~~ (~~1035-~~)] [~~200-~~ (~~1380-~~)] ~~psig~~ (kPa) minimum pressure rating and ends sized to fit adjoining pipes.
- D. Center-Sleeve Material: Stainless steel.
- E. Gasket Material: Natural or synthetic rubber.
- F. Metal Component Finish: Corrosion-resistant coating or material.

## 2.12 EXPANSION JOINTS AND DEFLECTION FITTINGS

- A. Ductile-Iron, Flexible Expansion Joints:
  1. Source Limitations: Obtain ductile-iron, flexible expansion joints from single manufacturer.
  2. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for ~~250-psig~~ (~~1725-kPa~~) minimum working pressure and for offset and expansion indicated.
- B. Ductile-Iron Expansion Joints:
  1. Source Limitations: Obtain ductile-iron expansion joints from single manufacturer.
  2. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron [~~or~~] [~~steel with protective coating~~]; bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53.
  3. Pressure Rating: ~~250-psig~~ (~~1725-kPa~~) minimum working pressure and for expansion indicated.
- C. Ductile-Iron Deflection Fittings:

1. Source Limitations: Obtain ductile-iron deflection fittings from single manufacturer.
2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include AWWA C111/A21.11, ductile-iron glands, rubber gaskets, and steel bolts. Include AWWA C111/A21.11 ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig (1725 kPa) minimum.

## 2.13 BACKWATER VALVES

- A. Cast-Iron Backwater Valves:
  1. Source Limitations: Obtain cast-iron backwater valves from single manufacturer.
  2. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
  3. Horizontal type; with swing check valve and hub-and-spigot ends.
  4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
  5. Terminal type; with bronze seat, swing check valve, and hub inlet.
- B. PVC Backwater Valves:
  1. Source Limitations: Obtain PVC backwater valves from single manufacturer.
  2. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

## 2.14 CLEANOUTS

- A. Cast-Iron Cleanouts:
  1. Source Limitations: Obtain cast-iron cleanouts from single manufacturer.
  2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
  3. Top-Loading Classification(s): **[Light Duty] [Medium Duty] [Heavy Duty] [and] [Extra-Heavy Duty]**.
  4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.
- B. PVC Cleanouts:
  1. Source Limitations: Obtain PVC cleanouts from single manufacturer.
  2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.15 DRAINS

- A. Cast-Iron Area Drains:

1. Source Limitations: Obtain cast-iron area drains from single manufacturer.
  2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round[ **secured**] grate. Include bottom outlet with inside caulk or spigot connection, of sizes indicated.
  3. Top-Loading Classification(s): [**Medium Duty**] [**and**] [**Heavy Duty**].
- B. Cast-Iron Trench Drains:
1. Source Limitations: Obtain cast-iron trench drains from single manufacturer.
  2. Description: ASME A112.6.3, **6-inch- (150-mm-)** wide top surface, rectangular body with anchor flange or other anchoring device, and rectangular[ **secured**] grate. Include units of total length indicated and quantity of bottom outlets with inside caulk or spigot connections, of sizes indicated.
  3. Top-Loading Classification(s): [**Medium Duty**] [**Heavy Duty**] [**and**] [**Extra-Heavy Duty**].
- C. Steel Trench Drains:
1. Source Limitations: Obtain steel trench drains from single manufacturer.
  2. Description: Factory fabricated from ASTM A242/A242M, welded steel plate, to form rectangular body with uniform bottom downward slope of 2 percent toward outlet, anchor flange, and grate. Include units of total length indicated, bottom outlet of size indicated, outlet strainer, acid-resistant enamel coating on inside and outside surfaces, and grate with openings of total free area at least two times cross-sectional area of outlet.
  3. Plate Thicknesses: [**1/8 inch (3.2 mm)**] [**and**] [**1/4 inch (6.4 mm)**].
  4. Overall Widths: [**7-1/2 inches (190 mm)**] [**and**] [**12-1/3 inches (313 mm)**].
- D. Grate Openings: [**1/4 inch (6.4 mm) circular**] [**3/8 inch (9.5 mm) circular**] [**3/8 inch (9.5 mm) circular or 3/8-by-3-inch (9.5-by-76-mm) slots**] [**3/8-by-3-inch (9.5-by-76-mm) slots**].
- 2.16 ENCASEMENT FOR PIPING
- A. Standard: ASTM A674 or AWWA C105/A21.5.
- B. Material: [**Linear low-density polyethylene film of 0.008-inch (0.20-mm)**] [**or**] [**cross-laminated HDPE film of 0.004-inch (0.10-mm)**] minimum thickness.
- C. Form: Sheet.
- D. Color: Black.
- 2.17 MANHOLES
- A. Standard Precast Concrete Manholes:

1. Description: **ASTM C478 (ASTM C478M)**, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: **48 inches (1200 mm)** minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: **6-inch (150-mm)** minimum thickness for floor slab and **4-inch (102-mm)** minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: **4-inch (102-mm)** minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: **ASTM C990 (ASTM C990M)**, bitumen or butyl rubber.
8. Resilient Pipe Connectors: **ASTM C923 (ASTM C923M)**, cast or fitted into manhole walls, for each pipe connection.
9. Steps: **[Individual FRP steps or FRP ladder] [Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] [ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] <Insert material>**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch (300- to 400-mm)** intervals. Omit steps if total depth from floor of manhole to finished grade is less than **[60 (1500)] <Insert dimension> inches (mm)**.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, **6- to 9-inch (150- to 225-mm)** total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: **ASTM C990 (ASTM C990M)**, bitumen or butyl rubber.
4. Resilient Pipe Connectors: **ASTM C923 (ASTM C923M)**, cast or fitted into manhole walls, for each pipe connection.
5. Steps: **[Individual FRP steps or FRP ladder] [Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] [ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] <Insert material>**, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls

at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than [60 (1500)] <Insert dimension>inches (mm).

6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.18 CONCRETE

A. General: Cast-in-place concrete in accordance with ACI 318 (ACI 318M), ACI 350 (ACI 350M), and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
  - a. Invert Slope: 1 percent through manhole.
2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, **3000 psi (20.7 MPa)** minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 (420 MPa) deformed steel.

## 2.19 PLASTIC, CHANNEL DRAINAGE SYSTEMS

A. General Requirements for Plastic, Channel Drainage Systems:

1. Modular system of plastic channel sections, grates, and appurtenances.
2. Designed so grates fit into frames without rocking or rattling.
3. Number of units required to form total lengths indicated.

B. HDPE or PE Channel Drainage Systems:

1. Source Limitations: Obtain HDPE or PE channel drainage systems from single manufacturer.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
3. Channel Sections: Interlocking-joint, HDPE or PE modular units, with end caps. Include flat, rounded, or inclined bottom, with level invert and with outlets in number, sizes, and locations indicated.
  - a. Dimensions: **4 inches (102 mm)** wide. Include number of units required to form total lengths indicated.
4. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.
  - a. Material: Stainless steel.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

## 2.20 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: **ASTM C478 (ASTM C478M)**, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: **6-inch (150-mm)** minimum thickness for floor slab and **4-inch (102-mm)** minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.



3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
  4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  5. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
  6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
  7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
  8. Steps: [Individual FRP steps or FRP ladder] [Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] [ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] <Insert material>, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than [60 (1500)] <Insert dimension>inches (mm).
  9. Pipe Connectors: ASTM C923 (ASTM C923M), resilient, of size required, for each pipe connecting to base section.
- B. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.
1. Joint Sealants: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
  2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
  3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
  4. Steps: [Individual FRP steps or FRP ladder] [Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] [ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP] <Insert material>, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than [60 (1500)] <Insert dimension>inches (mm).
  5. Pipe Connectors: ASTM C923 (ASTM C923M), resilient, of size required, for each pipe connecting to base section.



- C. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.
  - 1. Size: **24 by 24 inches (610 by 610 mm)** minimum unless otherwise indicated.
  - 2. Grate Free Area: Approximately 50 percent unless otherwise indicated.
- D. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include **24-inch (610-mm)** ID by **7- to 9-inch (175- to 225-mm)** riser with **4-inch- (102-mm-)** minimum width flange, and **26-inch- (660-mm-)** diameter flat grate with small square or short-slotted drainage openings.
  - 1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

## 2.21 STORMWATER INLETS

- A. Curb Inlets: Made with vertical curb opening.
- B. Gutter Inlets: Made with horizontal gutter opening. Include heavy-duty frames and grates.
- C. Combination Inlets: Made with vertical curb and horizontal gutter openings[, **of materials and dimensions in accordance with utility standards**]. Include heavy-duty frames and grates.
- D. Frames and Grates: Heavy duty[, **in accordance with utility standards**].

## 2.22 STORMWATER DETENTION STRUCTURES

- A. Cast-in-Place Concrete, Stormwater Detention Structures: Constructed of reinforced-concrete bottom, walls, and top; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.
  - 1. Ballast: Increase thickness of concrete as required to prevent flotation.
  - 2. Grade Rings: Include two or three reinforced-concrete rings, of **6- to 9-inch (150- to 229-mm)** total thickness, that match **24-inch- (610-mm-)** diameter frame and cover.
  - 3. Steps: [**Individual FRP steps or FRP ladder**] [**Individual FRP steps; FRP ladder; or ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP**] [**ASTM A615/A615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D4101, PP**] <Insert material>, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch (300- to 400-mm)** intervals. Omit steps if total depth from floor of

structure to finished grade is less than [60 (1500)] <Insert dimension>inches (mm).

- B. Manhole Frames and Covers: ASTM A536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange, and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

## 2.23 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregularly sized and shaped, graded stone in accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control."
  - 1. Average Size: NSSGA No. R-3, screen opening 2 inches (51 mm).
  - 2. Average Size: NSSGA No. R-4, screen opening 3 inches (76 mm).
  - 3. Average Size: NSSGA No. R-5, screen opening 5 inches (127 mm).
- C. Filter Stone: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
- D. Energy Dissipaters: In accordance with NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton (2721-kg) average weight armor stone, unless otherwise indicated.

## 2.24 DRY WELLS

- A. Description: ASTM C913, precast, reinforced, perforated concrete rings. Include the following:
  - 1. Floor: Cast-in-place concrete.
  - 2. Cover: Liff-off-type concrete cover with cast-in lift rings.
  - 3. Wall Thickness: 4 inches (102 mm) minimum with 1-inch (25-mm) diameter or 1-by-3-inch- (25-by-76-mm-) maximum slotted perforations arranged in rows parallel to axis of ring.
    - a. Total Free Area of Perforations: Approximately 15 percent of ring interior surface.
    - b. Ring Construction: Designed to be self-aligning.
  - 4. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.
- B. Manufactured PE Dry Wells:

1. Description: Manufactured PE side panels and top cover that assemble into 50-gal. (190-L) storage capacity units.
2. Source Limitations: Obtain manufactured PE dry wells from single manufacturer.
3. Side Panels: With knockout ports for piping and seepage holes.
4. Top Cover: With knockout port for drain.
5. Filter Fabric: As recommended by unit manufacturer.
6. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.

C. Description: Constructed-in-place aggregate type. Include the following:

1. Lining: Clay or concrete bricks.
2. Lining: Concrete blocks or precast concrete rings with notches or weep holes.
3. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch (19- to 63-mm) washed, crushed stone or gravel.
4. Cover: Precast, reinforced-concrete slab, designed for structural loading in accordance with ASTM C890 and made in accordance with ASTM C913. Include slab dimensions that will extend 12 inches (300 mm) minimum beyond edge of excavation, with bituminous coating over entire surface. Cast cover with opening for manhole in center.
5. Manhole: 24-inch- (610-mm-) diameter, reinforced-concrete access lid with steel lift rings. Include bituminous coating over entire surface.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

### 3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping in accordance with the following:
  - 1. Install piping pitched down in direction of flow.
  - 2. Install piping [**NPS 6 (DN 150)**] **<Insert value>** and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
  - 3. Install piping with [**36- (915-)**] [**48- (1220-)**] [**60- (1520-)**] [**72- (1830-)**] **<Insert dimension>** **inch- (mm-)** minimum cover.
  - 4. Install hub-and-spigot, cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 5. Install hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 6. Install ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
  - 7. Install corrugated-steel piping in accordance with ASTM A798/A798M.
  - 8. Install corrugated-aluminum piping in accordance with ASTM B788/B788M.
  - 9. Install ABS sewer piping in accordance with ASTM D2321 and ASTM F1668.
  - 10. Install PE corrugated sewer piping in accordance with ASTM D2321.
  - 11. Install PVC cellular-core piping in accordance with ASTM D2321 and ASTM F1668.
  - 12. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.
  - 13. Install PVC profile gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.
  - 14. Install PVC water-service piping in accordance with ASTM D2321 and ASTM F1668.
  - 15. Install fiberglass sewer piping in accordance with ASTM D3839 and ASTM F1668.
  - 16. Install nonreinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."
  - 17. Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."
- G. Install force-main pressure piping in accordance with the following:
  - 1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
  - 2. Install piping with [**36- (915-)**] [**48- (1220-)**] [**60- (1520-)**] [**72- (1830-)**] **<Insert dimension>** **inch- (mm-)** minimum cover.

3. Install ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41.
  4. Install ductile-iron special fittings in accordance with AWWA C600.
  5. Install PVC pressure piping in accordance with AWWA M23, or ASTM D2774 and ASTM F1668.
  6. Install PVC water-service piping in accordance with ASTM D2774 and ASTM F1668.
- H. Install corrosion-protection piping encasement over the following underground metal piping in accordance with ASTM A674 or AWWA C105/A21.5:
1. Hub-and-spigot, cast-iron soil pipe and fittings.
  2. Hubless cast-iron soil pipe and fittings.
  3. Ductile-iron pipe and fittings.
  4. Expansion joints and deflection fittings.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
1. Join hub-and-spigot, cast-iron soil piping with gasketed joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  2. Join hub-and-spigot, cast-iron soil piping with caulked joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
  3. Join hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
  4. Join ductile-iron culvert piping in accordance with AWWA C600 for push-on joints.
  5. Join ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
  6. Join corrugated-steel sewer piping in accordance with ASTM A798/A798M.
  7. Join corrugated-aluminum sewer piping in accordance with ASTM B788/B788M.
  8. Join ABS sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
  9. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
  10. Join PVC cellular-core piping in accordance with ASTM D2321 and ASTM F891 for solvent-cemented joints.
  11. Join PVC corrugated sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
  12. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.
  13. Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
  14. Join fiberglass sewer piping in accordance with ASTM D3839 for elastomeric-seal joints.

15. Join nonreinforced-concrete sewer piping in accordance with **ASTM C14 (ASTM C14M)** and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

B. Join force-main pressure piping in accordance with the following:

1. Join ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings in accordance with AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping in accordance with AWWA M23 for gasketed joints.
4. Join PVC water-service piping in accordance with ASTM D2855 for solvent-cemented joints.
5. Join dissimilar pipe materials with pressure-type couplings.

### 3.4 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping where indicated.
- B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.
- C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

### 3.5 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
  1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
  3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
  4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, [**18 by 18 by 12 (450 by 450 by 300)**] <Insert dimensions> inches (mm) deep. Set with tops [**1 (25)**] <Insert dimension> inch(es) (mm) above surrounding earth grade.

- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

### 3.6 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
  - 1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
  - 2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
  - 3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
  - 4. Use Extra-Heavy-Duty, top-loading classification drains in roads.
- B. Embed drains in 4-inch- (102-mm-) minimum concrete around bottom and sides.
- C. Fasten grates to drains if indicated.
- D. Set drain frames and covers with tops flush with pavement surface.
- E. Assemble trench sections with flanged joints.
- F. Embed trench sections in 4- (102-) inch- (mm-) minimum concrete around bottom and sides.

### 3.7 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 (76) inches (mm) above finished surface elsewhere unless otherwise indicated.

### 3.8 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

### 3.9 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

### 3.10 CONCRETE PLACEMENT

- A. Place cast-in-place concrete in accordance with **ACI 318** (**ACI 318M**).

### 3.11 CHANNEL DRAINAGE SYSTEM INSTALLATION

- A. Install with top surfaces of components, except piping, flush with finished surface.
- B. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
- C. Embed channel sections and drainage specialties in **4- (102-) inch- (mm-)** minimum concrete around bottom and sides.
- D. Fasten grates to channel sections if indicated.
- E. Assemble channel sections with flanged or interlocking joints.
- F. Embed channel sections in **4- (102-) inch- (mm-)** minimum concrete around bottom and sides.

### 3.12 STORMWATER DISPOSAL SYSTEM INSTALLATION

- A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill in accordance with chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.
- B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, in accordance with piping manufacturer's written instructions.



### 3.13 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 14 13 "Facility Storm Drainage Piping."
- B. Connect force-main piping to building's storm drainage force mains specified in Section 22 14 13 "Facility Storm Drainage Piping." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
    - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
    - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  - 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- D. Connect to sediment interceptors specified in Section 22 13 23 "Sanitary Waste Interceptors."
- E. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
  - 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

- a. **[Unshielded]** **[Shielded]** flexible couplings for same or minor difference OD pipes.
- b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
- c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

### 3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  1. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
  1. Remove manhole or structure and close open ends of remaining piping.
  2. Remove top of manhole or structure down to at least **[36 (915)]** **<Insert dimension>** inches (mm) below final grade. Fill to within **[12 (300)]** **<Insert dimension>** inches (mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade in accordance with Section 31 20 00 "Earth Moving."

### 3.15 IDENTIFICATION

- A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  1. Use warning tape or detectable warning tape over ferrous piping.
  2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.16 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
  - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  - 4. Submit separate report for each test.
  - 5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    - b. Option: Test plastic piping in accordance with ASTM F1417.
  - 6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 (1035) psig (kPa).
    - a. Ductile-Iron Piping: Test in accordance with AWWA C600, "Hydraulic Testing" Section.
    - b. PVC Piping: Test in accordance with AWWA M23, "Testing and Maintenance" Chapter.
- C. Leaks and loss in test pressure constitute defects that must be repaired.

- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.17 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 33 42 00

## SECTION 33 46 00 - SUBDRAINAGE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Perforated-wall pipe and fittings.
2. Drainage conduits.
3. Drainage panels.
4. Geotextile filter fabrics.

#### 1.2 RELATED DOCUMENTS

- A. Standard Specifications for Public Works Construction, 2021 ("Green Book"), including all subsequent addenda and supplements.

#### 1.3 ACTION SUBMITTALS

A. Product Data:

1. Drainage conduits, including rated capacities.
2. Drainage panels, including rated capacities.
3. Geotextile filter fabrics.

### PART 2 - PRODUCTS

#### 2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. **NPS 6 (DN 150)** and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. **NPS 8 (DN 200)** and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

- B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

## 2.2 DRAINAGE CONDUITS

- A. Molded-Sheet Drainage Conduits: Prefabricated geocomposite with cusped, molded-plastic drainage core wrapped in geotextile filter fabric.
  - 1. Nominal Size:
    - a. 12 Inches (305 mm) High by Approximately 1 Inch (25 mm) Thick: With minimum in-plane flow of 30 gpm (114 L/min.) at hydraulic gradient of 1.0 when tested in accordance with ASTM D4716.
    - b. 18 Inches (457 mm) High by Approximately 1 Inch (25 mm) Thick: With minimum in-plane flow of 45 gpm (170 L/min.) at hydraulic gradient of 1.0 when tested in accordance with ASTM D4716.
  - 2. Filter Fabric: PP geotextile.
  - 3. Fittings: HDPE with combination NPS 4 and NPS 6 (DN 100 and DN 150) outlet connection.

## 2.3 SOIL MATERIALS

- A. Soil materials are specified in Section 31 20 00 "Earth Moving."

## 2.4 WATERPROOFING FELTS

- A. Material: Comply with ASTM D226, Type I, asphalt-saturated organic felt.

## 2.5 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested in accordance with ASTM D4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament.
  - 1. Survivability: AASHTO M 288 Class 2.
  - 2. Styles: Flat and sock.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

- C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into subdrainage system.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

### 3.3 FOUNDATION DRAINAGE INSTALLATION

- A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than **6 inches (150 mm)** deep and **12 inches (300 mm)** wide.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than **4 inches (100 mm)**.
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.
- F. Add drainage course to width of at least **6 inches (150 mm)** on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping to width of at least **6 inches (150 mm)** on side away from footing and above top of pipe to within **12 inches (300 mm)** of finish grade.
- H. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- I. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least **4 inches (100 mm)**.
- J. Install drainage panels on foundation walls as follows:
  - 1. Coordinate placement with other drainage materials.
  - 2. Lay perforated drainage pipe at base of footing. Install as indicated in Part 3 "Piping Installation" Article.
  - 3. Separate **4 inches (100 mm)** of fabric at beginning of roll and cut away **4 inches (100 mm)** of core. Wrap fabric around end of remaining core.
  - 4. Attach panels to wall beginning at subdrainage pipe. Place and secure molded-sheet drainage panels, with geotextile facing away from wall.

- K. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Thoroughly compact each layer. Final backfill to finish elevations and slope away from building.

### 3.4 UNDERSLAB DRAINAGE INSTALLATION

- A. Excavate for underslab drainage system after subgrade material has been compacted but before drainage course has been placed. Include horizontal distance of at least 6 inches (150 mm) between drainage pipe and trench walls. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
- D. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive.
- E. Install drainage piping as indicated in Part 3 "Piping Installation" Article for underslab subdrainage.
- F. Add drainage course to width of at least 6 inches (150 mm) on side away from wall and to top of pipe to perform tests.
- G. After satisfactory testing, cover drainage piping with drainage course to elevation of bottom of slab, and compact and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Install horizontal drainage panels as follows:
  - 1. Coordinate placement with other drainage materials.
  - 2. Lay perforated drainage pipe at inside edge of footing.
  - 3. Place drainage panel over drainage pipe with core side up. Peel back fabric and wrap fabric around pipe. Locate top of core at bottom elevation of floor slab.
  - 4. Butt additional panels against other installed panels. If panels have plastic flanges, overlap installed panel with flange.

### 3.5 RETAINING-WALL DRAINAGE INSTALLATION

- A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches (100 mm).
- C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with adhesive.
- D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.



- E. Add drainage course to width of at least **6 inches (150 mm)** on side away from wall and to top of pipe to perform tests.
- F. After satisfactory testing, cover drainage piping to width of at least **6 inches (150 mm)** on side away from footing and above top of pipe to within **12 inches (300 mm)** of finish grade.
- G. Place drainage course in layers not exceeding **3 inches (75 mm)** in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least **4 inches (100 mm)**.
- I. Install drainage panels on wall as follows:
  - 1. Coordinate placement with other drainage materials.
  - 2. Lay perforated drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
  - 3. If weep holes are used instead of drainage pipe, cut **1/2-inch- (13-mm-)** diameter holes on core side at weep-hole locations. Do not cut fabric.
  - 4. Mark horizontal chalk line on wall at a point **6 inches (150 mm)** less than panel width above footing bottom. Before marking wall, subtract footing width.
  - 5. Separate **4 inches (100 mm)** of fabric at beginning of roll and cut away **4 inches (100 mm)** of core. Wrap fabric around end of remaining core.
  - 6. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Place nails from **2 to 6 inches (50 to 150 mm)** below top of panel, approximately **48 inches (1200 mm)** apart. Construction adhesives may be used instead of nails.. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
  - 7. If another panel is required on same row, cut away **4 inches (100 mm)** of installed panel core and wrap fabric over new panel.
  - 8. If additional rows of panel are required, overlap lower panel with **4 inches (100 mm)** of fabric.
  - 9. Cut panel as necessary to keep top **12 inches (300 mm)** below finish grade.
  - 10. For inside corners, bend panel. For outside corners, cut core to provide **3 inches (75 mm)** for overlap.
- J. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding **6 inches (150 mm)**. Thoroughly compact each layer. Fill to finish grade.

### 3.6 LANDSCAPING DRAINAGE INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than **4 inches (100 mm)**.
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least **6 inches (150 mm)** between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within **12 inches (300 mm)** of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least **4 inches (100 mm)**.
- I. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding **6 inches (150 mm)**. Thoroughly compact each layer. Fill to finish grade.

### 3.7 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions and other requirements indicated.
  - 1. Foundation Subdrainage: Install piping level and with a minimum cover of **36 inches (915 mm)** unless otherwise indicated.
  - 2. Underslab Subdrainage: Install piping level.
  - 3. Plaza Deck Subdrainage: Install piping level.
  - 4. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of **36 inches (915 mm)** unless otherwise indicated.
  - 5. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of **36 inches (915 mm)** unless otherwise indicated.
  - 6. Lay perforated pipe with perforations down.
  - 7. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install thermoplastic piping in accordance with ASTM D2321.

### 3.8 PIPE JOINT CONSTRUCTION

- A. Join perforated PE pipe and fittings with couplings in accordance with ASTM D3212 with loose banded, coupled, or push-on joints.
- B. Join perforated PVC sewer pipe and fittings in accordance with ASTM D3212 with loose bell-and-spigot, push-on joints.
- C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

### 3.9 BACKWATER VALVE INSTALLATION

- A. Comply with requirements for backwater valves specified in Section 33 41 00 "Storm Utility Drainage Piping."
- B. Install horizontal backwater valves in header piping downstream from perforated subdrainage piping.
- C. Install horizontal backwater valves in piping in manholes where indicated.

### 3.10 CLEANOUT INSTALLATION

- A. Comply with requirements for cleanouts specified in Section 33 41 00 "Storm Utility Drainage Piping."
- B. Cleanouts for Foundation Subdrainage:
  - 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
  - 2. In vehicular-traffic areas, use **NPS 4 (DN 100)** cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, **18 by 18 by 12 inches (450 by 450 by 300 mm)** deep. Set top of cleanout flush with grade.
  - 3. In nonvehicular-traffic areas, use **NPS 4 (DN 100)** **[cast-iron] [PVC]** pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, **[12 by 12 by 4 inches (300 by 300 by 100 mm)]** **<Insert dimensions>** deep. Set top of cleanout **[1 inch (25 mm)]** **[2 inches (50 mm)]** **<Insert dimension>** above grade.
  - 4. Comply with requirements for concrete specified in Section 03 30 00 "Cast-in-Place Concrete."
- C. Cleanouts for Underslab Subdrainage:
  - 1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. Use **NPS 4 (DN 100)** cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

### 3.11 CONNECTIONS

- A. Comply with requirements for piping specified in Section 33 41 00 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.
- C. Where required, connect low elevations of foundation subdrainage to stormwater sump pumps. Comply with requirements for sump pumps specified in Section 22 14 29 "Sump Pumps."

### 3.12 IDENTIFICATION

- A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 31 20 00 "Earth Moving."
  1. Install PE warning tape or detectable warning tape over ferrous piping.
  2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.13 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
  2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- B. Drain piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.14 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00

APPENDIX G  
SCHEDULE OF VALUES

**Appendix (SPP SOV)**  
**SCHEDULE OF VALUES (SOV)**

	Item Description	ITEM VALUE
<b>1</b>	<b>BUILDING SELECTIVE DEMOLITION (interior and exterior demolition including MEP and safe off)</b>	
	DEMO AND REMOVE ALL ITEMS INDICATED, AS INDICATED ON THE PLANS AND SPECIFICATIONS	
	REMOVE (E) BUILT-OUT ROOFING	
	REMOVE (E) ROOF RIGID INSULATION	
	REMOVE (E) WINDOWS- PREP TO RECEIVE NEW WINDOWS	
	REMOVE (E) LOUVERS. PREP TO RECEIVE NEW LOUVERS	
	REMOVE (E) ROLL UP GRILLES. PATCH AND REPAIR WALLS AS REQUIRED	
	REMOVE (E) DOORS. PREP TO RECEIVE NEW DOORS	
	REMOVE (E) GLUE-ON TILE CEILING. PATCH AND REPAIR AS REQUIRED	
	REMOVE (E) PREP EXISTING WALLS AND CEILING TO RECEIVE NEW PAINT THROUGHOUT	
	REMOVE/DEMO ALL OTHER DEMO ITEMS NOT INCLUDED ABOVE (E)	
<b>2</b>	<b>COMMUNITY BUILDING NEW RENOVATION, INCLUDING EXTERIOR COURTYARD</b>	
	BUILDING CONCRETE & REINFORCING STEEL (EXCLUDING SITE PAVEMENT)	
	STRUCTURAL STEEL & MISCELLANEOUS	
	METAL DECKING	
	SITE METAL FENCE/STEEL GATES	
	EXTERIOR LOUVERS	
	ROUGH CARPENTRY/WOOD FRAMING	
	CARPENTRY AND SOLID SURFACE	
	STANDING SEAM METAL OVER WATERPROOFING MEMBRANE OVER RIGID INSULATION AND RIGID INSULATION	
	SHEET METAL, FLASHING/COUNTERFLASHING & SCUPPERS/DOWNSPOUTS	
	WINDOW AND FREE STANDING METAL SCREENS	
	HOLLOW METAL AND WOOD DOOR	
	DOORS, FRAMES & FINISH HARDWARE	
	GLASS AND GLAZING SYSTEM	
	METAL STUD FRAMING, DRYWALL & BATT INSULATION	
	PLASTER SYSTEM	
	FLOORING	
	CONCRETE FLOOR SEALER	
	PAINTING	
	TOILET PARTITIONS AND ACCESSORIES	
	BUILDING CODE SIGNAGE	
	BUILDING AND COURTYARD PLUMBING	
	BUILDING HVAC SYSTEM COMPLETE	
	BUILDING AND COURTYARD ELECTRICAL SYSTEM COMPLETE INCLUDING LOW VOLTAGE AND SECURITY SYSTEM (BUILDING AND SITE)	
	BUILDING FIRE ALARM	
	SECURITY SYSTEM	
	INCLUDE ALL OTHER NEW ITEM NOT INCLUDED ABOVE	

<b>3</b>	<b>CONSTRUCT NEW BASKETBALL COURT</b>	
	FOOTPRINT CLEARING/GRADING	
	BASKETBALL COURT CONCRETE PAVEMENT	
	BASKETBALL COURT STRIPING	
	BASKETBALL BACKSTOP & HOOP	
	INCLUDE IF ALTERNATE 2 ACCEPTED:	
	BASKET BALL LIGHTING INCLUDE FOOTING	
<b>4</b>	<b>CONSTRUCT A NEW SPLASH PAD AND PUMP HOUSE</b>	
	CONSTRUCT SPLASH PAD COMPLETE INCLUDING CONCRETE PAD	
	CONSTRUCT PUM HOUSE COMPLETE INCLUDE SLAB, FOUNDATION, STEEL STRUCTURE, MASONRY WALL, ROOF DOORS PLUMBING, AND ELECTRICAL	
	PROVIDE SPLASH PAD ELECTRICAL	
	PROVIDE SPLASH PAD PLUMBING	
	PROVIDE EXTERIOR SHOWER	
<b>5</b>	<b>CONSTRUCT A NEW SKATE PARK</b>	
	CONSTRUCT SKATE PARK COMPLETE	
<b>6</b>	<b>ALTERNATE CONSTRUCT A WALKING PAD WITH ELEVEN (11) EXERCISE/WORKOUT STATIONS (NORTH PARK &amp; PARKING LOT)</b>	
	BASE BID SCOPE IF ACCEPTED:	
	PROVIDE ELECTRICAL CONDUIT WITH PULL STRING FROM THE SKATE PARK'S NORTH LIGHT POLE TO THE EXISTING NORTH PARK PARKING LOT'S FIRST LIGHT POLE LOW VOLTAGE CAMERAS	
	FULL SCOPE IF ALTERNATE 1 ACCEPTED:	
	<b>LANDSCAPING</b>	
	TURF TO BE REMOVED	
	TREE TO BE REMOVED	
	SHRUB TO BE REMOVED	
	EXISTING IRRIGATION TO BE REMOVED (VALVES B, C, D, & E; MAINLINE LATERAL; QUICK COUPLER; & NEW TEMPORARY IRRIGATION TO BE INSTALLED)	
	WASTE CONTAINER	
	DRINKING FOUNTAIN	
	BICYCLE RACK	
	NEW IRRIGATION EQUIPMENT (PRESSURE REGULATING VALVE, MASTER VALVE, FLOW SENSOR, RAINBIRD INLINE LRBY150D LARGE CAPACITY DISC FILTER)	
	ELEVEN (11) NEW EXERCISE EQUIPMENT PIECES (AB CRUNCH / LEG LIFT & CHEST / BACK PRESS, BALANCE STEPS & HAND CYCLER - ADA, ASSISTED ROW W/ PUSHUP, ELLIPTICAL, HEALTHBEAT STYLE PARALLEL BARS, SINGLE SLATED RPL BOARD CLIMBER, PLYOMETRICS DB, STEEL POST 1/2 & 0 ATTACHMENTS DB, STRETCH DB, JUMP TOUCH DB ONLY, 2" HORIZONTAL LADDER)	
	DECOMPOSED GRANITE	
	NEW NATURAL TURF SOD	
	<b>LIGHTING</b>	
	PROVIDE LIGHT AT NORTH PARK AS INDICATED ON THE NORTH POLE ELECTRICAL PLAN- INCLUDE POE FOOTING	
	<b>CIVIL ITEMS</b>	
	SAWCUT AND REMOVE CONCRETE CURB	
	CONSTRUCT CONCRETE CURB	

	INSTALL TRUNCATED DOMES	
	GRADING FOR DECOMPOSED GRANITE PATH	
	GRADING FOR EXERCISE STATION AREAS	
7	<b>CONSTRUCT TWO (2) NEW PICNIC SHELTERS WITH SAIL SHADE STRUCTURES AT SKATE PARK (INCLUDE FOOTING)</b>	
	CONSTRUCT 2 SHADE STRUCTURE COMPLETE INCLUDING FOOTING	
8	<b>CONSTRUCT PLAZA AREA SAIL SHADE STRUCTURES, INCLUDING FOOTING</b>	
	CONSTRUCT PLAZA AREA SAIL SHADE STRUCTURES, INCLUDING FOOTING	
9	<b>CONSTRUCTION LANDSCAPING AND NEW LIGHTING THROUGHOUT THE PARK (SOUTH SECTION)</b>	
	<b>SOUTH PARK LANDSCAPING</b>	
	TURF TO BE REMOVED	
	TREE TO BE REMOVED	
	SHRUB TO BE REMOVED	
	NEW LATERAL PVC SCH 40	
	INSTALL 4" PVC SCH. 40 IRRIGATION WATER LINE AND FITTINGS	
	INSTALL 2" PVC SCH. 40 IRRIGATION WATER LINE AND FITTINGS	
	HEADS (SPRAY HEADS, TREE & SRUB BUBBLERS)	
	VALVES (PRESSURE REGULATING VALVE, MASTER VALVE, FLOW SENSOR, RAINBIRD INLINE LRBY150D LARGE CAPACITY DISC FILTER, QUICK COUPLER VALVE, PVC BALL VALVE	
	NEW IRRIGATION CONTROLLERS (WEATHERTRAK ET PRO3 PEDESTAL MOUNT OUTDOOR & WEATHERTRAK ET PRO3 WALL MOUNT INDOOR)	
	24" BOX TREES	
	15 GALLON SHRUBS	
	5 GALLON SHRUBS	
	1 GALLON SHRUBS	
	NEW COLORED CONCRETE (DARK CHARCOAL, ASH WHITE, DARK RED)	
	NEW DECOMPOSED GRANITE	
	NEW NATURAL TURF SOD	
	BOULDERS	
	DECORATIVE LANDSCAPE POTS	
	SITE FURNITURE (WASTE CONTAINERS, DRINKING FOUNTAINS, BENCHES W/ ARMRESTS, STANDARD TABLES, ADA TABLES, PEDESTAL PARK GRILL, STEEL COAL ASH RECEPTACLE, BICYCLE RACK, FLAGPOLE	
	<b>SOUTH PARK SITE ELECTRICAL</b>	
	SITE ELECTRICAL DEMOLITION	
	SITE LITE POLE COMPLETE SYSTEM INCLUDING FOOTING	
	BOLLARD LIGHT COMPLETE SYSTEM INCLUDING FOOTING	
	DECORATIVE COVE LIGHT COMPLETE SYSTEM	
	SITE POWER COMPLETE INCLUDING ELECTRICAL EQUIP, MENY, CONDUITS, FEEDERS, AND TERMINATION	
	LOW VOLTAGE AND CAMERA SYSTEM COMPLETE	
	INCLUDE ALL OTHER ELECTRICAL WORK NOT MENTIONED ABOVE	



10	CIVIL ITEMS	
	<b>DEMOLITION</b>	
	SAWCUT EXISTING PAVEMENT OR CURB	
	REMOVE EXISTING CURB	
	REMOVE EXISTING CONCRETE WALK	
	REMOVE EXISTING CONCRETE ACCESS RAMP	
	REMOVE EXISTING CONCRETE CURB & GUTTER	
	REMOVE EXISTING ASPHALT PAVEMENT AND BASE	
	REMOVE EXISTING CONCRETE WHEEL STOP	
	REMOVE EXISTING SIGN, POST, & FOOTING	
	<b>GRADING AND PAVING</b>	
	EARTHWORK OPERATION: PERFORM ALL EXCAVATION , BACKFILL, GENERAL GRADING	
	FINE GRADING EXPORT/ IMPORT AS MAY BE REQUIRED	
	CONSTRUCT COMMERCIAL DRIVEWAY APPROACHES	
	CONSTRUCT CONCRETE CURB PER SPPWC STD. 120-3, TYPE A1	
	CONSTRUCT TRUNCATED DOME	
	CONSTRUCT CONCRETE MOW STRIP	
	CONSTRUCT FULL DEPTH AC REPLACEMENT	
	CONSTRUCT CONCRETE SLOUGH WALL INCLUDING FOOTING	
	CONSTRUCT CONCRETE BLOCK WALL INCLUDING FOOTING	
	CONSTRUCT BIO-RETENTION BMP	
	INSTALL CONCRETE WHEEL STOP	
	INSTALL CONCRETE CATCH BASIN	
	CONSTRUCT STANDARD GRAY COLOR CONCRETE SIDEWALK, WALK WAYS AND AREA PAVING	
	CONSTRUCT INTEGRAL COLOR CONCRETE SIDEWALK, WALK WAYS AND AREA PAVING	
	CONSTRUCT CONCRETE RIP-RAP	
	CONSTRUCT CONCRETE CURB AND GUTTER PER SPPWC STD. 120-3, TYPE A2	
	CONSTRUCT MODIFIED CURB DRAIN	
	SAWCUT AND REMOVE EXISTING CURB FACE. FLUSH WITH EXISTING AC PAVEMENT.	
	ADJUST UTILITY ACCESS COVER TO GRADE. REPLACE WITH NEW	
	CONSTRUCT DRAINAGE WELL	
	<b>UTILITY</b>	
	INSTALL 6" CPVC SCH. 40 STORM DRAIN AND FITTINGS	
	INSTALL 4" CPVC SCH. 40 STORM DRAIN AND FITTINGS	
	INSTALL ANGULAR DOWNSPOUT BOOT WITH CLEANOUT	
	INSTALL STORM DRAIN CLEANOUT	
	INSTALL 6" ATRIUM GRATE	
	INSTALL 4" ATRIUM GRATE	
	CONNECT TO EXISTING STORM DRAIN PIPE	
	REMOVE AND DISPOSE OF EXISTING CATCH BASIN	
	REMOVE AND DISPOSE OF EXISTING STORM DRAIN PIPE	
	INSTALL 2" PVC SCH. 40 WATER LINE AND FITTINGS	
	INSTALL 3" PVC SCH. 40 WATER LINE AND FITTINGS	
	CONNECT TO EXISTING WATER LINE	

	INSTALL 4" PVC SCH. 40 WATER LINE AND FITTINGS	
	INSTALL CONCRETE THRUST BLOCK	
	TRENCH AND BACKFILL	
	INSTALL 3/4" PVC SCH. 40 WATER LINE AND FITTINGS	
	REMOVE AND CAP EXISTING WATER LINE	
	EROSION & SEDIMENT CONTROL	
	INSTALL STABILIZED CONSTRUCTION ENTRANCE/EXIT	
	INSTALL MATERIAL STORAGE AREA	
	INSTALL GRAVEL BAGS	
	INSTALL CONCRETE WASTE MANAGEMENT AREA	
	INSTALL STORM INLET PROTECTION	
	INSTALL 6' HIGH CHAIN LINK FENCE AND GATE WITH GREEN SCREEN	
	INSTALL SANITARY/SEPTIC WASTE MANAGEMENT	
	STREET SWEEPING	
	INSTALL FIBER ROLL	
	INCLUDE ALL OTHER NEW ITEM NOT INCLUDED ABOVE	
<b>11</b>	<b>GENERAL REQUIREMENTS</b>	
	PROJECT CLOSE OUT	
	SURVEY	
	MATERIAL TESTING & INSPECTION	
	HAZMAT REMEDIATION	
	TERMITE REMEDIATION	
	<b>TOTAL CONTRACT VALUE</b>	

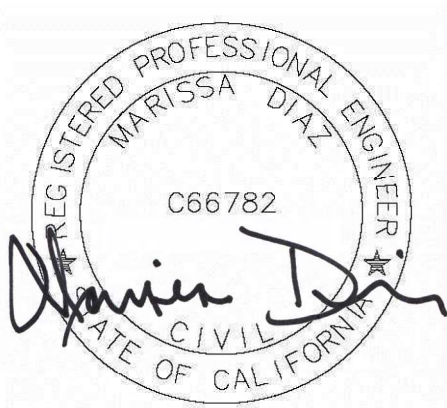
APPENDIX H

QUALITY ASSURANCE PROGRAM

# CITY OF LANCASTER QUALITY ASSURANCE PLAN



October 17, 2019



Senior Manager – Capital Programs

10/17/19

Date

City of Lancaster  
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Lancaster, CA 93534  
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# **CITY OF LANCASTER QUALITY ASSURANCE PROGRAM**

## **1.0 INTRODUCTION**

The City of Lancaster (City) Quality Assurance Program (QAP) is a sampling and testing program that will provide assurance that the materials and workmanship incorporated in each public works construction project are in conformance with the contract specifications. The three elements of a Quality Assurance Program are Acceptance Testing (AT), Independent Assurance Program (IAP), and Testing of Manufactured Materials.

Acceptance Testing (AT) is comprised of procedures for regular testing of materials entering a construction project to verify that the materials, or products, comply with contract specifications or standards. The IAP is comprised of procedures to verify that acceptance testing is performed correctly by verifying equipment calibration, witnessing sampling and testing by acceptance tester, and by comparing the test results between testers. The Testing of Manufactured Materials facilitates the review and acceptance of manufactured and prefabricated materials either by source inspection, job site inspection, or Certificate of Compliance. This QAP, as approved by the Director of Public Works, meets Caltrans requirements for all Federally funded National Highway System (NHS) and non-NHS transportation projects.

Until such time the City employs its own in-house quality assurance personnel and laboratory facilities, it shall contract with other qualified local Agencies or qualified private consulting laboratories, which must be approved for such work as described later in this document. Materials testing and sampling costs may be reimbursable through the construction engineering phase of a project. Local Programs Procedures will apply.

City construction projects shall be in general compliance with the currently adopted Caltrans Standard Specifications, unless otherwise specified in the plans and specifications. Laboratories are required to comply with this QAP when contracted to provide inspection and/or materials testing services on City administered Federally funded projects. All materials provisions that apply to the consulting laboratory shall apply to the subcontracted Consultant as well.

The QAP for all local Agency projects shall include Acceptance Tests (AT). AT results shall be used to determine the quality and acceptability of materials and workmanship incorporated into the project.

## **2.0 GENERAL PROCEDURES**

The following criteria for sampling and testing shall be applied for both non-NHS and NHS projects:

### **2.1 Preliminary Tests**

- 2.1.1 Preliminary Tests are tests prior to award of a contract. Construction personnel rarely sample for Preliminary Tests. Such tests are for design purposes or to provide data for the

"Materials Information" package for prospective bidders. Samples and testing on potential sources sampled after award of the contract are typically called "Initial Samples and Tests," or "Process Control Samples and Tests." Normally, these samples and tests are performed on material proposed for use in the work by the Contractor to determine the ability of a material or product to meet specifications or to indicate to the Contractor the extent of processing and control required to produce a material that meets specifications.

## 2.2 Acceptance Sampling and Testing

- 2.2.1 Tests of materials entering the work are called "Acceptance Tests" (AT). Acceptance sampling and testing of materials or work should start the first day a construction material is placed or work is performed. To obtain the greatest benefit, testing should be performed as soon as possible after samples are taken or segments of work are completed. This provides early test data for the Engineer's and Contractor's guidance.
- 2.2.2 The Engineer shall maintain a material and testing "Summary Log" for each material requiring multiple sampling and testing as defined in Exhibit "A" of this document. The "Summary Log" shall include appropriate date, station location, depth of test sample, approximate quantity of material represented by the test sample, test result, and tester. Failing test results will require cross-referencing of the retest to the initial failing test result by a notation on each report.
- 2.2.3 Representative samples of all materials entering into the work shall be sampled at the location specified in the standard specifications, special provisions or as directed by the Engineer.

## 2.3 Source Inspection

- 2.3.1 Source Inspection is acceptance testing of manufactured and prefabricated materials at a location other than the job site. Unless otherwise specified, inspection is required at the source for such typical materials and fabricated items as bituminous paving mixtures, structural concrete, metal fabrication, metal casting, welding, concrete pipe manufacture, protective coating application, and similar shop or plant operations.

## 2.4 Reporting Test Results

- 2.4.1 The following are goals for reporting material tests results to the Engineer:
  - A. When the aggregate is sampled at the material plant, test results for Sieve Analysis, Sand Equivalent and Cleanness Value should be submitted to the Engineer within 24 hours after sampling.
  - B. When materials are sampled at the job site, test results for compaction and maximum density should be submitted to the Engineer within 24 hours after sampling.

- C. When soils and aggregates are sampled at the job site, test results for Sieve Analysis, Sand Equivalent and Cleanness Value should be submitted to the Engineer within 72 hours after sampling.
  - D. When soils and aggregates are sampled at the job site, test results for "R" Value and asphalt concrete extraction should be submitted to the Engineer within 72 hours after sampling.
- 2.4.2 When sampling products such as Portland Cement Concrete (PCC), cement-treated base (CTB), asphalt concrete (AC), and other such materials, the time of such sampling shall be varied with respect to the time of day insofar as is possible, in order to avoid a predictable sampling routine. The reporting of AT test results, for tests not performed by the Engineer's staff, shall be done on an expedited basis, such as by fax or telephone, followed up with an e-mailed copy.
- 2.4.3 The reporting of acceptance test results shall be done on an expedited basis, such as by fax or telephone, followed up with an e-mailed copy.

### 2.5 Independent Assurance Program

- 2.5.1 The primary purpose of the Independent Assurance Program is to:
- A. Verify that project sampling and testing materials are performed correctly (i.e., the tester).
  - B. Verify certification and qualifications of Acceptance testers.
  - C. Ensure that equipment is properly calibrated.

## **3.0 PUBLIC WORKS PROJECTS AND NON-NATIONAL HIGHWAY SYSTEM PROJECTS**

All public works and Federal-Aid projects off the National Highway System shall abide by the following procedures:

### 3.1 Correlation Testing Program

- 3.1.1 The laboratory utilized for acceptance testing must be a participant in one or more of the following Caltrans' approved (Caltrans Office of Materials, Engineering and Testing Services) correlation testing programs:
- A. The AASHTO Materials Reference Laboratory (AMRL)
  - B. Cement and Concrete Reference Laboratory (CCRL)
  - C. Caltrans' own Reference Samples Program (RSP)

The Contractor shall provide proof of this association in a submitted bid proposal.



### 3.2Qualifying Laboratories

- 3.2.1 A private consulting laboratory may be permitted to subcontract materials testing provided the test results are received by the Engineer within 7 days after materials are sampled. The subcontractor must be approved by the local Agency, and must be a participant in an approved correlation testing program. All materials provisions that apply to the consulting laboratory shall apply to the subcontracted Consultant.
- 3.2.2 Any laboratory providing testing services for projects located in California (except for products manufactured out of state) shall be under the responsible engineering management of a California registered Professional Engineer with experience in inspection and testing of construction materials. The Engineer shall certify the results of all tests performed by laboratory personnel under his supervision.
- 3.2.3 The Contractor shall not select or exercise any authority over the consulting laboratory.

### 3.3 Sampling and Testing Materials

- 3.3.1 The City will commonly hire a Consultant to perform sampling and testing of materials, however, the following are available options for testing:
  - A. Laboratory operated by another local Agency meeting the qualifications of this QAP.
  - B. Private Consultant laboratory meeting the requirements of this QAP.
  - C. Require a Certificate of Compliance from the supplier in lieu of testing manufactured products.

### 3.4Certification of Personnel

- 3.4.1 Any laboratory providing testing services for projects located in California (except for products manufactured out of state) shall be under the responsible engineering management of a California registered Professional Engineer with experience in inspection and testing of construction materials.
- 3.4.2 This Engineer shall individually certify personnel upon receiving evidence of training, experience, and/or certification by a non-Caltrans organization such as the “National Institute for Certification in Engineering Technologies” (NICET). This certification is required for all samplers and testers. Individual Acceptance Testers with a current “Certificate of Proficiency for an Acceptance Tester” issued by Caltrans are accepted as valid Acceptance Testers.
- 3.4.3 A copy of each person’s Certificate of Proficiency is to be on file in both contracted laboratories’ and the City Engineer’s project files.
- 3.4.4 Acceptance testers without valid identification for a specific test and/or sampling, so ordered to perform, shall not be allowed to perform that specific sampling and/or testing.

### 3.5 Laboratory Equipment Calibration Requirements

- 3.5.1 All laboratories shall maintain their laboratory testing equipment, at a minimum, in accordance with Section 2.4.2.2 of the Caltrans Independent Assurance Manual.
- 3.5.2 Local Agencies and/or private Consultants electing to use nuclear test equipment shall calibrate nuclear gauges on Caltrans' standard density blocks. Calibration arrangements should be made by contacting a Caltrans authorized 3<sup>rd</sup> party calibrator, a Caltrans Independent Assurance Sampler and Tester, or a Caltrans Radiation Safety officer. A minimum of three (3) working days' advance notice is required for nuclear gauge calibration.

### 3.6 Manufactured and Assembled Materials

- 3.6.1 The City may waive material testing requirements and permit the use of certain manufactured products, materials or assemblies that are accompanied by a Certificate of Compliance, provided these products, materials or assemblies do not involve structural integrity or public safety. The manufacturer of the products, materials or assemblies shall sign the Certificate of Compliance and state the included materials and workmanship conform, in all respects, to the project specifications for the material.

### 3.7 Certificate of Compliance

- 3.7.1 Acceptance of manufactured and prefabricated structural materials shall be based on either a Certificate of Compliance and/or source inspection by the City or its qualified Consultant. Source inspection is acceptance testing of manufactured and prefabricated materials at locations other than the job site. The certified material lot number and project number shall be clearly identified on the certificate and on lot tags affixed or stenciled to the released materials. All materials accepted on the basis of a signed Certificate of Compliance shall be noted by project inspectors on daily inspection reports and laboratory releases.
- 3.7.2 The contract documents shall specify which materials require a Certificate of Compliance. In addition to the specifications, see listing of materials typically accepted by a Certificate of Compliance for projects advertised using Caltrans Standard Specifications, most current edition, for reference.
- 3.7.3 Manufactured products, materials or assemblies used on the basis of a Certificate of Compliance may be sampled again at the job site and tested at any time during the term of the contract. Items found not in conformance with contract requirements shall be subject to rejection whether in place or not.
- 3.7.4 It shall be the responsibility of the Contractor to protect and ensure the integrity of materials, products and assemblies upon delivery to the project site.

### 3.8 Performing Independent Assurance Sampling and Testing

- 3.8.1 The City may utilize an individually qualified local Agency or private Consultant testers to perform the work. Private Consultant testers used to perform Independent Assurance Sampling and Testing shall be free of conflicts of interest and shall not be performing the acceptance testing for the Contractor under contract for the given Federal-aid project.
- 3.8.2 It shall be at the discretion of the Engineer as to the need for and the extent of Independent Assurance Sampling and Testing.
- 3.8.3 Independent Assurance Sampling and Testing is to be done in a manner that shall avoid needless duplication.

### 3.9 Frequency of the Testing

- 3.9.1 The Frequency of testing is noted in Exhibit “A” of this document and provides for sampling and testing as required for various materials and products. Close adherence to the sample size requirement avoids the unnecessary delay and expense of obtaining supplementary samples to complete the tests.
- 3.9.2 The frequency of sampling is intended as a guide under normal conditions. Material well within specifications and uniform in character may result in less frequent sampling and testing, whereas borderline materials may need an increase in the frequency of testing to assure specification compliance. Materials supplied from reliable sources and proven by frequent testing to be of uniform high quality may subsequently receive less sampling and testing than indicated in the frequency testing tables. However, any deviation from the prescribed frequency must be noted and explained in the material testing records. When materials are being furnished intermittently, with interruptions of several days or weeks, the frequency of sampling and testing should be increased to assure that specification materials are being incorporated into the work.
- 3.9.3 Whenever failures occur, sufficient additional acceptance tests should be taken to isolate the affected work. Documentation of the results of such additional tests shall be included in the records, including a description of the corrective measures taken.
- 3.9.4 Relatively minor quantities of construction materials may be accepted without testing provided acceptance conforms to the conditions stated below. Generally, this provides for accepting minor quantities of materials from a commercial source that is known to be a supplier of specification material.
- 3.9.5 The Engineer, on the basis of a visual examination, may accept minor quantities of materials without testing, provided the source of the supplies has recently furnished similar materials found to be satisfactory using Caltrans sampling and testing requirements.
- 3.9.6 Acceptance of a product may be established on the basis of certification by the manufacturer or supplier that the material furnished complies with all specification requirements.

- 3.9.7 Documentation for acceptance of material as described above must be provided and included in the project records. The documentation should include statements in the project inspector's reports that clearly indicate conditions under which the material was accepted.

#### **4.0 NATIONAL AND STATE HIGHWAY SYSTEM PROJECTS**

The City shall employ the following procedures for Federal-aid projects involving NHS and SHS roads:

##### **4.1 Correlation Testing Program**

- 4.1.1. The utilized laboratory for acceptance testing must be a participant in one or more of the following Caltrans' approved (Caltrans Office of Materials Engineering and Testing Services) correlation testing programs:
- A. The AASHTO Materials Reference Laboratory (AMRL)
  - B. Cement and Concrete Reference Laboratory (CCRL)
  - C. Caltrans' Reference Samples Program (RSP)

##### **4.2 Qualifying Laboratories**

- 4.2.1 A private consulting laboratory may be permitted to subcontract materials testing provided the test results are received by the Engineer within 7 days after materials are sampled. The subcontractor must be approved by the local Agency and must be a participant in an approved correlation testing program. All materials provisions that apply to the consulting laboratory shall apply to the subcontracted Consultant.
- 4.2.2 Any laboratory providing testing services for projects located in California (except for products manufactured out of state) shall be under the responsible engineering management of a California registered Professional Engineer with experience in inspection and testing of construction materials. The Engineer shall certify the results of all tests performed by laboratory personnel under his supervision.
- 4.2.3 The Contractor shall not select or exercise any authority over the consulting laboratory.

##### **4.3 Certification of Personnel**

- 4.3.1 Acceptance sampling and testing shall be performed only by personnel who have been certified by the Caltrans District Materials Engineer, or other designated district authority, and deemed proficient in acceptance sampling and testing. These personnel shall possess a current "Certificate of Proficiency for an Acceptance Tester," (TL-0111) (old Form HC-I) (Exhibit I6-D) which is valid in all districts. This certificate is required for all samplers and testers, including Consulting laboratory employees and employees of sub-contracted laboratories.

- 4.3.2 The Caltrans District Materials Engineer and/or Caltrans Independent Assurance Engineer shall individually certify personnel of local Agencies and Consultant employees upon receiving evidence of training, experience and/or certification by an authorized, non-Caltrans organization such as the "National Institute for Certification in Engineering Technologies" (NICET).
- 4.3.3 A copy of each person's Certificate of Proficiency is to be on file in both the District Materials Laboratory's and the City Engineer's project files. The TL-0111 form lists the sampling and testing which the individual is authorized to perform.
- 4.3.4 A person possessing the TL-0111 Certification issued on the basis of a certification from NICET or other organizations recognized by Caltrans, if observed by qualified personnel, not to be performing materials sampling and testing in accordance with applicable test methods, shall have his or her T-0111 certification withdrawn or modified for the particular test method observed to have been incorrectly performed.
- 4.3.5 During witness and split sample testing, acceptance testers should carry adequate identification so Independent Assurance sampling and testing personnel can verify certification. Acceptance testers without valid identification shall not be allowed to perform sampling and testing.
- 4.3.6 A person whose certification has been withdrawn for a particular test method may have the certification revalidated upon demonstration that deficiencies have been eliminated to the satisfaction of the Caltrans District Materials Engineer.
- 4.3.7 In cases of extreme emergency, sampling and testing may be performed by someone not certified. The Engineer is to assure himself or herself of the person's competency and every effort should be made to obtain a certified person as soon as possible. These occasions should be limited to unforeseen circumstances. Prior arrangements shall be made to have certified personnel available for foreseeable occasions such as vacation, compensating time off, rotation, or separation.

#### 4.4 Laboratory Equipment Calibration Requirements

- 4.4.1 The laboratory utilized for acceptance testing shall calibrate all field and laboratory equipment prior to use on construction projects and re-calibrate as frequently as required per Section 2.4.2.2 of the Caltrans Independent Assurance Manual. The maximum interval between calibrations is one year.
- 4.4.2 The consulting laboratory, including any sub-consulting laboratory, shall provide written evidence of current calibration to the City prior to entering any contractual agreement to perform acceptance testing. In addition, the consulting laboratory, including any sub-consulting laboratory, shall re-calibrate at the request of the Engineer. All calibration evidence shall be provided to the Caltrans District Materials Engineer upon request.
- 4.4.3 Calibration of test equipment shall conform to Section 8-03, "Field Tests," of the Caltrans *Construction Manual*.

- 4.4.4 When nuclear test equipment is used to determine soil, aggregate or asphalt concrete compaction, such equipment shall be calibrated on Caltrans' standard density blocks. Calibration arrangements should be made by contacting a Caltrans authorized 3<sup>rd</sup> party calibrator, a Caltrans Independent Assurance Sampler and Tester, or a Caltrans Radiation Safety officer. A minimum of 3 working days advance notice is required for nuclear gage calibration. Nuclear gages not calibrated on Caltrans' standard density blocks shall not be accepted. Specified calibration tables for each device shall be used for all State and Federally-funded contracts on the NHS. All nuclear gage compaction tests conducted without Caltrans' calibration tables shall be reported "Unacceptable" by Caltrans' IA personnel authorized 3<sup>rd</sup> party calibrator.
- 4.4.5 Upon proper calibration, a decal shall be firmly affixed to each piece of calibrated equipment. Decal type and required information are specified on page 63, Appendix B, of the Caltrans *Quality Assurance Program Manual*. A manufacturer's or service Contractor's decal is acceptable as long as the above-required information is readily available.
- 4.4.6 Should such decal become unreadable or lost, then the equipment is to be re-calibrated as soon as possible. Where such equipment either requires repair or cannot be repaired, a timely repair or replacement shall be secured.
- 4.4.7 All laboratories shall maintain their laboratory testing equipment in accordance with recognized national calibration standards.

#### 4.5 Use of Caltrans to Perform Equipment Calibration

- 4.5.1 Should the City choose to utilize a Caltrans laboratory to perform equipment calibration, the City and/or Caltrans District Local Assistance Engineer (DLAE) must furnish the following to the appropriate Caltrans District Materials Engineer:
- A. A letter requesting required testing services (letter should note if ASTM methods shall be used in lieu of the California Test Method (CTM));
  - B. Specific instruction on how the Agency is to be billed;
  - C. An Engineering Authorization number provided by the Caltrans DLAE.
- 4.5.2 An advance deposit (procedures and amounts of advance deposits vary by Caltrans Districts) is required to cover the cost of calibration done by Caltrans. All such requests shall be made through the appropriate Caltrans DLAE.

#### 4.6 Manufactured and Assembled Materials

- 4.6.1 The City may permit the use of certain manufactured products, materials or assemblies accompanied by a Certificate of Compliance prior to sampling and testing, provided these products, materials or assemblies do not involve structural integrity or safety to the public. Additionally, these items must have a history of having met specifications based upon

previous sampling and testing. The manufacturer of the products, materials or assemblies shall sign the Certificate of Compliance and state that the included materials and workmanship conform in all respects to the project specifications.

#### 4.7 Certificate of Compliance

- 4.7.1 Acceptance of manufactured and prefabricated structural materials shall be based on either a Certificate of Compliance and/or source inspection by the City, qualified Consultant, or Caltrans authorized personnel.
- 4.7.2 The contract documents should specify which materials require a Certificate of Compliance. For such specified materials, the Engineer is responsible for insuring that a Certificate of Compliance is furnished with each lot of these materials delivered to the work site. The certified material lot number and project number shall be clearly identified on the certificate and on lot tags affixed or stenciled to the released materials. All materials accepted on the basis of a signed Certificate of Compliance shall be referenced by project inspectors to daily inspection reports and laboratory releases. Certified materials such as Portland Cement and Asphalt products shall be sampled for testing as indicated in the "Size, Frequency and Location of Sampling and Testing Tables" (Exhibit "A") (hereinafter referred to as "Frequency Tables").
- 4.7.3 Manufactured products, materials or assemblies used on the basis of a Certificate of Compliance may be sampled again at the job site and tested at any time during the life of the contract. Items found later not in conformance with contract requirements shall be subject to rejection whether in place or not. The form and distribution of Certificates of Compliance shall be acceptable to the DLAE. A Certificate of Compliance for each item shall be kept in the Engineer's file.

#### 4.8 Performing Independent Assurance Sampling and Testing

- 4.8.1 Independent Assurance sampling and testing is mandatory for all NHS projects. Caltrans shall perform the Independent Assurance Sampling and Testing. The Engineer shall schedule on a timely basis with the Caltrans Materials Engineer, the Independent Assurance testing of his/her personnel responsible for the Acceptance testing on the project. The frequency of Independent Assurance Sampling and Testing to be performed or witnessed by the Independent Assurance personnel are listed in the Caltrans *Quality Assurance Manual*.
- 4.8.2 Independent Assurance samples are taken at random for the purpose of making independent checks on the reliability of the Acceptance Test results. Both Independent Assurance Test samples and Acceptance Test samples should be taken from the same point in the material delivery process, and are split samples for purposes of comparing test results between Independent Assurance Sampling and Testing personnel and field laboratory (acceptance) tester. Independent Assurance Sampling and Testing does not have to be performed on materials actually incorporated into the work. The tests, however, shall be performed while a project is active and the same acceptance tester and testing equipment shall be used for the project. The split sample is to be tested separately by the field acceptance testing laboratory

person and by the Independent Assurance laboratory person using separate equipment. Independent Assurance samples are to be tested on equipment that is not assigned to the project.

- 4.8.3 All sampling by Independent Assurance testing personnel must be identified as an Independent Assurance sample even when the number of samples or tests may exceed the sampling schedule. Such identity must be maintained throughout the testing procedure. Independent Assurance samples shall be kept under the direct control of the Independent Assurance sampler until they are shipped or delivered to the testing laboratory.
- 4.8.4 Acceptance tester results are compared with Independent Assurance results by the Caltrans District Materials Engineer. The Engineer is responsible to see that the frequency of Independent Assurance testing is conducted in accordance with the Caltrans *Quality Assurance Program Manual*. The Caltrans District Materials Engineer is responsible for the resolution of testing differences and reporting results to the Engineer in a timely manner.
- 4.8.5 Poor correlation between Acceptance Testers' results and the Independent Assurance Testers' results indicate probable deficiencies with the job quality acceptance sampling and testing procedures. Independent Assurance samples and tests are not to be used for determining compliance with contract requirements. The frequency of Independent Assurance Sampling and Testing is described in the Caltrans *Quality Assurance Program Manual*, Section 3-13, "Performing Independent Assurance Sampling and Testing Functions."
- 4.8.6 The following are the procedures to follow for Independent Assurance Sampling and Testing when performed on all NHS local Agency contracts:
- A. Independent Assurance Sampling and Testing is required for each Federal-Aid contract on NHS. The Caltrans DLAE is responsible for assuring that there is a continual process in the district where the Engineer and the Independent Assurance laboratory are notified prior to the start of work. This is accomplished by forwarding a copy of the PS&E package to the District Materials Engineer for review and determination of the required Independent Assurance requirements. The Independent Assurance requirements are then sent to the DLAE on Form MR-0102, "Independent Assurance Sampling and Testing." The Independent Assurance requirements are determined from the Caltrans *Quality Assurance Program Manual* and are recorded on either the "Report of Witness Test" (Form MR-0103) or the "Corroboration Report" (Form MR-104). Results are retained in summary on the "Independent Assurance Sampling and Testing Log Summary Sheet" (See the Caltrans *Quality Assurance Program Manual*, Appendix C for examples of forms mentioned above). The frequency of Independent Assurance Sampling and Testing is specified in Table 1, "Frequency of Split Sample and Witness Tests" of the Caltrans *Quality Assurance Program Manual*. The DLAE is responsible for assuring that acceptance testing and Independent Assurance Activities are monitored by the Engineer during the construction phase of each Federal-Aid project on the NHS.
  - B. The Engineer is responsible for the timely notification of the appropriate Material Laboratory when Independent Assurance Testing is needed.



- C. Independent Assurance samples are to be tested on a priority basis. Independent Assurance testing personnel are to promptly compare test results with Acceptance Tests performed by project personnel. Acceptability of the purpose of satisfying Independent Assurance requirements rests solely with comparing test results, not on meeting contract requirements. The District Materials Engineer is responsible for resolving differences when Independent Assurance sampling and testing results compare poorly with acceptance sampling and test results. The District Materials Engineer shall immediately report the poor comparison results to the Engineer by telephone or fax. He/she shall also transmit to the Engineer, the "Corroboration Report." A copy shall also be sent to the DLAE.
- D. The District Materials Engineer shall immediately initiate follow-up actions whenever poor comparisons are noted between Independent Assurance and Acceptance Test results. Independent Assurance Testing personnel's follow-up actions may include further Independent Assurance sampling and testing, and the results placed in the Engineer's file, with a copy furnished to the Caltrans DLAE. The District Materials Engineer shall continue follow-up actions until the discrepancies are resolved.
- E. The appropriate Materials Laboratory shall retain the original "Independent Assurance Sampling and Testing Log Summary." If a Consultant Independent Assurance is used then a copy of the log summary for each acceptance tester shall be submitted to the Engineer upon project completion. This copy shall be retained in the construction project files.

Note: The use of the following Caltrans forms for local Agency projects is on an optional basis for reporting Independent Assurance activities and/or results and information relating to Independent Assurance. The local Agency or its Consultant testing organization may use any similar form that provides the same information as the forms listed below:

- "Independent Assurance Sampling and Testing" (Form MR-0102)
  - "Report of Witness Tests" (Form MR-0103)
  - "Corroboration Report" (Form MR-0104)
  - "Independent Assurance Sampling and Testing Log Summary" (Form MR0110)
- F. Independent Assurance testing is to be done in a manner that shall avoid needless duplication. The construction sampling and/or testing person may be working on several different construction projects concurrently, utilizing the same equipment during the same time period. When this is the case, it is not necessary to make Independent Assurance tests for all projects. Instead, the results can be incorporated into each appropriate project file to show that the sampler and/or tester has been performing the job correctly, and that the testing equipment is in proper working order.
- G. In order to provide required documentation for multiple construction projects as described above, each Independent Assurance sampling or test result shall be entered into the Independent Assurance Sampling and Testing Log Summary for the person tested. This

summary is retained by the Independent Assurance personnel and shall be readily available for future reference. Applicable contracts, sample identification numbers, and tests performed can be traced to the Independent Assurance Sampling and Testing Log Summary. Copies of the Independent Assurance Sampling and Testing log summary for each acceptance sampler and tester shall be provided to each affected Engineer for inclusion in their respective files.

#### 4.9 Frequency of Testing

- 4.9.1 The frequency of testing is to be performed per the sampling and testing frequency tables within the most current California Department of Transportation Quality Assurance Program (QAP) Manual or the project specifications, whichever is most stringent.
- 4.9.2 Whenever failures occur, sufficient additional acceptance tests should be taken to isolate the affected work. Documentation of the results of such additional tests shall be included in the records, including a description of the corrective measures taken.
- 4.9.3 Relatively minor quantities of construction materials may be accepted without testing provided acceptance conforms to the conditions stated below. Generally, this provides for accepting minor quantities of materials from a commercial source that is known to be a supplier of specification material.
- 4.9.4 The Engineer, on the basis of a visual examination, may accept minor quantities of materials without testing, provided the source of the supplies has recently furnished similar materials found to be satisfactory using Caltrans sampling and testing requirements.
- 4.9.5 Acceptance of a product may be established on the basis of certification by the manufacturer or supplier that the material furnished complies with all specification requirements.
- 4.9.6 Documentation for acceptance of material as described above must be provided and included in the project records. The documentation should include statements in the project inspector's reports that clearly indicate conditions under which the material was accepted.

#### **5.0 TESTING FREQUENCY**

Exhibit "A" of this document provides a guide for sampling and testing required for various materials and products that are used on a Public Works Project or Non-National Highway System Project. For Projects that are State or National Highway Systems, the sampling frequency shall be as stated in the most current California Department of Transportation Quality Assurance Program (QAP) Manual or the project specifications, whichever is most stringent. Close adherence to the sample size requirement avoids the unnecessary delay and expense of obtaining supplementary samples to complete the tests.

The frequency of sampling is intended as a guide under normal conditions. Material well within specifications and uniform in character may result in less frequent sampling and testing, whereas borderline materials may need an increase in the frequency of testing to assure specification

compliance. Materials supplied from reliable sources and proven by frequent testing to be of uniform high quality, may subsequently receive less sampling and testing than indicated in the Frequency Testing Tables; however, any deviation from the prescribed frequency must be noted and explained in the material testing records. When materials are being furnished intermittently, with interruptions of several days or weeks, the frequency of sampling and testing should be increased to assure that specification materials are being incorporated into the work.

Whenever failures occur, sufficient additional acceptance tests should be taken to isolate the affected work. Documentation of the results of such additional tests shall be included in the records, including a description of the corrective measures taken.

Relatively minor quantities of construction materials may be accepted without testing provided acceptance conforms to the conditions stated below. Generally, this provides for accepting minor quantities of materials from a commercial source that is known to be a supplier of specification material.

The Engineer, on the basis of a visual examination, may accept minor quantities of materials without testing provided the source of the supplies has recently furnished similar materials found to be satisfactory using normal sampling and testing requirements.

Acceptance of a product may be established on the basis of certification by the manufacturer or supplier that the material furnished complies with all specification requirements.

Documentation for acceptance of material as described in paragraphs 1 and 2 above must be provided and included in the project records. Documentation should include statements in the project inspector's reports that clearly indicate conditions under which the material was accepted (e.g., description, quantity, location, where placed, certification numbers and/or other accompanying data).

## **6.0 RECORDS**

All material records of samples and tests, material releases and Certificates of Compliance for a given project shall be incorporated into the Engineer's project file. This file shall be organized as described in Section 16.8, "Project Files," of the Caltrans Local Assistance Procedures Manual. The complete project file shall be available at a single location for inspection by Caltrans and FHWA personnel at any time during the construction project. The file shall be available at the local Agency administrative office for at least three years following the date of final payment. The use of a "Summary Log," as described in "Acceptance Sampling of Testing," facilitates reviews of material sampling and testing by Caltrans and FHWA reviewing personnel, and assists the Engineer in tracking the frequency of testing.

When two or more projects are being furnished materials simultaneously from a single plant, it is not necessary to secure separate samples for each project; however, individual test reports are to be supplied to complete the records for each project.

## **7.0 PROJECT CERTIFICATION**

Upon completion of the project, a "Materials Certificate" shall be completed by the Engineer. The City shall include a "Materials Certificate" in the Report of Expenditures submitted to the Caltrans District Director, Attention: District Local Assistance Engineer. A copy of the "Materials Certificate" shall also be included in the local Agency construction records. The Construction Manager in charge of the construction function for the City shall sign the certificate. All materials incorporated into the work which did not conform to specifications must be explained and justified on the "Materials Certificate," including changes by virtue of contract change order

### **REFERENCES**

1. State of California, Department of Transportation LAPM Chapter 16. June 10, 2011 Edition
2. State of California, Department of Transportation QAP Manual, revised January 20, 2011

## EXHIBIT “A”

### Minimum Testing Frequency

#### Concrete Aggregate:

Conformance Testing Verification (within 12 months)

Sieve Analysis	CTM 202
Sand Equivalent (SE)	ASTM D2419 CTM 217
LA <del>Tattler</del> <sup>Rattler</sup>	ASTM C131 CTM 211
Sodium Soundness	ASTM C88
Organic Impurities	ASTM C40
Specific Gravity of Aggregate	CTM 206/207
Durability of Aggregate	CTM 229

#### Concrete:

Frequency: Initial and at least every 300CY

Slump	CTM 556
Air Content	CTM 504
Compressive Strength	CTM 521
Making of Concrete Cylinder	CTM 540
Density Test	CTM 518
Temperature	CTM 557

#### Asphalt Mix Design:

Frequency: 1 per mix per project

Sieve Analysis	CTM 202
Sand Equivalent (SE)	CTM 217
LA Rattler	CTM 211
Specific Gravity (agg)	CTM 206/207
Optimum Oil content	CTM 367
Maximum Density (Hveem)	CTM 304/308
Maximum Theoretical Density	CTM 309

#### Paving Asphalt/Liquid Asphalt/Asphalt Emulsion:

Frequency: Certificate of Compliance

## **EXHIBIT “A”**

### **Minimum Testing Frequency - Continued**

#### **Asphalt Concrete Mixture:**

Frequency: Every 500 tons of Placement or 1 per day

Oil Content	CTM 382
Gradation Analysis	CTM 202
Maximum Density (Hveem)	CTM 304/308
Maximum Theoretical Density	CTM 309
HVEEM Stability	CTM 366

#### **Aggregate Base/Aggregate Subbase:**

Frequency: Initial and 1 for every 3000 tons or source change

Sieve Analysis	CTM 202
Durability	CTM 229
R-Value	CTM 301
Sand Equivalent	CTM 217
Moisture (1 daily if paid by weight)	CTM 226
Relative Density (as necessary for acceptance)	CTM 231
Laboratory Relative Compaction	CTM 216

#### **Soil:**

Frequency: Every Soil change (2 minimum per project)

Maximum Density/Optimum Moisture	CTM 216
Expansion Index	ASTM D4829
Relative Compaction in place (as needed)	CTM 231